

AVIATION WEEK

MAY 10, 1954

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May 12, 1954

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Printing & Production

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FLYING THE "DEPERDUSSIN"

One of Cessna's Early Airplanes

In 1911 Clyde Cessna began building airplanes in Hot, Oklahoma, his home town. He called them "mossies" after watching a group being assembled in Oklahoma City. One of his earliest models to fly successfully was the "Deperdussin," shown below, a lightweight one-man monoplane. Clyde Cessna had no flight instructor—but taught himself to fly just as the Oklahoma soil flew!



The Cessna "Four-Ten" biplane—Model 330

As the science of flight developed through the years, petroleum research kept pace with the demands for more powerful and efficient aviation fuels.

Phillips Petroleum Company is today one of the country's largest suppliers of aviation fuels for military, commercial and private use. In addition to a tremendous capacity for producing 115/145 grade aviation gasoline, Phillips is ready with improved fuels for the latest designs in turbo-prop and jets. Always depend on Phillips for reliable aviation products.

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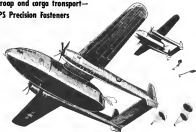


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Domestic

Vertical-takeoff transport development will be started this year by the General Corporation Aviation Safety Center in New York. First step will be a technical study of Navy's VTO fighters, several types of conventional, experimental aircraft that use boundary-layer control and helicopters.

Argo sales at U.S. Air Force base last week were estimated by one supplier to concerned airlines that could pay cash to guarantee their accounts through authorized suppliers. Contract operators were able to obtain credit by putting a security bond. The airline stemmed from a Senate charge that disreputable bills were introduced (Aviation Week Apr. 5, p. 15).

Walkout of 450 technicians occurred at Fairchild Engine & Airplane Corp.'s guided missile plant at Wyandanch, N. Y., last week after the IAM local membership rejected a wage increase negotiated by management and a bargaining committee working with a federal mediator. Terms of the rejected agreement were not disclosed.

Administration has submitted legislation to Congress that would increase control of the Undersecretary of Commerce for Transportation over allocation of airport funds and set a new policy of "national experience" rather than local needs as the yardstick for federal aid.

Walter Strohberg, president of Ruston Airlines, in a statement to Aviation Week declared that he has been approached by Northwest Orient Airlines. Ruston never mentioned him as the next CWA president.

Central of Link Aviation, Inc., last week was taken over by General Dynamics Equipment Corp., which purchased 51% of the Englewood, N. Y., company's outstanding stock (Aviation Week Mar. 22, p. 1). Link will now function to operate under its parent management.

Military Air Transport Service will take over McGee AFB, N. Y., from the Air Defense Command July 1, is scheduled to transfer MATS Atlantic Division headquarters to the base and back up the field to one of the largest on the East Coast.

Rock Aircraft Corp. has set up \$7 million in credit with the National City Bank of New York and the Fourth



Martin Flies First Production P5M-2

Recently destroyed down its earlier P5M-1 entry ship by the high-mounted T-tail, the first production Martin P5M-2 Marine amphibious flying boat ordered by Navy cuts the number of Chesapeake Bay as it takes off on its first flight Apr. 29. The P5M-2 also differs from the P5M-1 in its lower bow doors which can drop open while doing takeoff. Powered by two 1,600-hp. Wright J40-10A1 Turbo Compound engines, the new Marine has increased range, speed and higher takeoff gross weight.

National Bank of Wichita to provide financing for commercial and export business, U.S. military contracts and advances with other plane builders. The Wichita company also reports re-investment of as \$8 million V-bus.

Miller Helicopters has reduced the price tag on its three-place 120-hp. outboard motor to \$13,600, will meet most necessary items on the commercial version that was required by military specifications.

Finco Helicopter Corp.'s \$5,875,000 mortgage loan, authorized in 1951 to finance construction and equipping of new plant facilities at Morton, Pa., has been purchased by the Chase National Bank of New York from RFC, Philadelphia National Bank and the Trustmen Land Title Bank and Trust Co., also at Philadelphia, participated.

Piper Aircraft Corp., Lock Haven, Pa., has sold 12 PA-18 Super Cubs powered by 115-hp. Lycoming engines to Colombia for dual pilot training.

Legislative subcommittee on Assistant Secretary of Defense for Congressional Relations has been introduced by Rep. Stirling Cole, chairman of the Joint Congressional Atomic Energy Committee. The measure is pending before the House Armed Services Committee, of which Cole is a ranking member.

Rep. John Herbert V. Wiley (USN Ret.), longtime aviator who commanded Navy's (offshore) USS Moen and the only officer to survive the crash of the USS Albatross, died Apr. 26 at Pasadena, Calif. He was 61.

Markus W. Gertzel, 61, public relations director for General Motors

Corp.'s AC Spark Plug Division, died Apr. 22 in Chicago.

Financial

North American Aviation, Los Angeles, reports a net income of \$5,593,000 for the six months ended Mar. 31, compared with \$5,010,000 for the same period last year. Sales and income totaled \$794,160,596. Bookings Mar. 31: \$1,168,767,871.

Bell Aircraft Corp., Buffalo, N. Y., had a net income of \$1,009,569 for the first quarter of 1954, 96% higher than the first three months of 1953. Sales and income totaled \$457,390,034, compared with \$15,005,590 last year. Bookings Apr. 1: \$450,232,143.

Continental Air Lines had a net income of \$126,023 for the first quarter of 1954, compared with \$683,011 for the same period of 1953. This included a net operating income of \$46,446 from 12,795,120 revenue, \$135,590 net, \$2,407,787 revenues last year.

American Airlines has declared a regular quarterly dividend of 7 1/2 cents per share on 33.50 common shares on weekly preferred stock, payable June 1 to holders of record May 17.

Fairchild Engine & Airplane Corp., Englewood, Md., will pay 15-cent dividend May 28 on common shares to holders of record May 12.

International

Canadian aviation officials have denied a U.K. request to extend the bilateral air agreement to include landing rights for British Overseas Airways Corp. at Toronto's Malton Airport.

HOLD TIGHT!

PLUNGER —Extremely close tolerance is maintained between the nose and plunger guiding movement of plunger in a straight line at all times which is a necessary feature for smooth

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Fewer parts means greater durability

SPRING — Of highest quality tempered steel. Manufactured to apply greater tension than required in order to draw the national tariff together and ensure positive alignment at all

RETAINING WALLS—Provision made to
opposite freely in case

Notes – First quality steel. Extreme case is taken to hold dimensional tolerance to .001, requiring a more precise instrument. Because of these close tolerances and perfect alignment of all parts, the needles always move in unison and their sharpening surfaces contact the metal simultaneously, imperative for perfect mutual holding.

IMPROVE RAB - Top quality steel. Thinwalled, are held exceptionally close for smooth, easy operation and correct expansion of the rammer.



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LOCKHEED Super Canine flying laboratory with an Allison T38 turbojet engine in its left nacelle takes off from Norwalk, Conn., on start of test courses of T38-type powerplants to be used in Lockheed C-130 cargo plane. Other three engines are turbo types.

PLATUS 71 primary tractor is being tested by Swiss Defense Department. All metal work has attachable bicycle loading gear, 358-hp. Exceeding. Top speed is given as 100 mph.



NOTE Playbay, closed up some fast appetizers (Aktion Work Jan. 15, p. 94), now does 150 mph. More than 15 Playbays are being built from kits in U.S., says the designer.



ARIZTOSING WHITWORTH Males N. F. 14 (except highlights below) features a slimmer crop than refer N. F. 13, also has modified be with focus on slants of projecting "buffet" Flare is 49 H 11 is long. It has sides in root, four corners in wings.



24 Hours...1 Hostage

One by one, the veiled women boarded the plane, bound for the old world after a glimpse of the new. The shock was still in Washington, standing a diplomatic dinner. He would have tomorrow — tonight, he was reading his letters home.

But not understood. A stout, northern officer whispered down ahead, then, marveled openly to the Aircraft representative to persuade him into the plane.

It was a special service flight for the *Aircraft* man. He had just supervised the engine overhaul of the ship's plane and was now making the flight to inspect the native mechanics who would care for it in Saudi Arabia.

Once inside the plane, the guard loosened the

automatic in his holster significantly. As the plane took off, he observed, "If these engine apertures you will be the first to die." His tone was matter-of-fact, yet firm. The *Aircraft* man swallowed hard, but said nothing. What could he say?

The rest of the story is unadorned. The robust engine functioned perfectly — the flight was without further incident, thanks to *Aircraft*'s high standards of overhaul, involving history-man performance. *Aircraft* production line techniques are equal to those of the original manufacturer. That is the only way to get away with quality.

Aircraft will gladly handle your overhaul and supply problems. Ask about our personnel service, the *Aircraft* mechanic, and dealer programs.



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WHO'S WHERE

In the Front Office

William H. Coleman is new president of Aero Supply Manufacturing Co., Corp., Pa. A. M. Kinkaid, public relations director for Douglas Aircraft Co., and R. G. Farnham, general manager of the Long Beach Division, have been elected vice presidents of the Santa Monica Cold, Inc.

William H. Coleman, Jr., has been appointed vice president and sales manager of American Airlines.

D. P. Bonds has been elected vice president of Western Air Lines.

Paul Scheraga is vice president and general manager of Williams Manufacturing Co.'s new Berkeley Division, Chicago.

L. John Kishner has been promoted to Texas Texas Airways to vice president traffic and sales.

G. W. Fleming has become vice president and general manager of Flight Service, Inc., Denver, N. Y.

Albert Berg has been elected treasurer and controller of King Western Corp., Chicago.

H. H. Haskin-Graham is new secretary. Harold B. Smith, president of Thru-Tek World of Chicago, has been appointed a director of Capital Airlines.

Changes

F. Maurice McCaig, Canadian aviation pioneer, has joined Falcon International Airlines as general manager.

Dorel D. Coffin, manager of Raytheon Manufacturing Co.'s Missile and Radar Division at Bedford, Mass., has been appointed assistant vice president of the company.

William H. Wilson has been moved up by Hamilton Electronics Corp., Little Neck, N. Y., to assistant vice president.

Edward J. Gilman has become assistant secretary of EnCell-O Corp., Detroit.

Samuel M. Rosary, Jr., has been elected assistant secretary of Brynmor, Inc., Little Rock, N. Y.

Myron Coffer has joined Phil D. McHugh Advertising Agency, Los Angeles, as an executive for creative and client affairs.

R. E. Jones, former chief radio and electronic engineer for Raytheon Corp., is now technical product design for Williams Aircraft Division, Provoport, Ill.

Stanford M. Foster has been appointed supervisor of American Research Products' research and development control section at the Illinois Institute of Technology, Chicago.

Honors and Elections

Edw. Gen. Joseph T. Morris (USAF Ret.) received vice president of United Aircraft Products, Inc., will receive an honorary degree in Doctor of Science at May 1954 from Bowling Green State University, Bowling Green, Ohio, June 4.

Frederic S. Wilson, executive manager for United Air Lines, since 1949, has been elected president of the Midwest Insecticide Research Association.

INDUSTRY OBSERVER

USAF is studying the possibility of air-launching high-altitude rockets in early 1954 to 250,000 ft., according to Maj. Gen. Floyd E. Wood, Deputy Commander for Technical Operations of the Air Research and Development Command.

Sikorsky S-55 anti-submarine warfare helicopter (Aviation Week Mar. 1, p. 11) has reached a speed of 144 mph, an ideal flight during early flight testing. Designation of the S-55S, powered by Turbomeca Astazou turboprop, has been changed to S-59.

Western Electric Co. has shipped its first K-5 rifle bombing and navigation system to the Douglas Aircraft Long Beach Division for installation in the B-66B twin-engine USAF light bomber. This marks the first time Douglas has subcontracted development of a complete operational subsystem for one of its aircraft in line with the USAF weapons system development concept.

Lockheed plans to complete the shift of its T-33 trainer assembly line from Van Nuys to Palmdale, Calif., by mid-May (Aviation Week Apr. 26, p. 21). Last of the Van Nuys-built T-33s are scheduled to be flown to Palmdale by the end of May.

American Airlines recently flight-tested a Douglas DC-7 as the two-continenter's maiden voyage between New York and Los Angeles using an autopilot to determine if the scheduled time could be reduced. American also is studying the possibility of fuel-injected engines to increase speed of the DC-7.

Pittsfield H-19 helicopters are flying on a test basis following incorporation of 27 modifications ordered by USAF when the ships were grounded in February. Time scheduled by paper work is responsible for much of the delay in this program. Engineering changes for production and service helicopters were in the works for nearly a month before the company was given the green light to manufacture modification kits. The first ungrounded H-19 flew as April 5.

Recommending engines require 1.75 barrels of oil for 100 barrels of aviation gas consumed and jet engines use 0.125 barrels of oil for every 100 barrels of jet fuel burned, a USAF study shows.

Competition among helicopter manufacturers is bringing red heat to the Air Force and Navy. At least one company has cut the price on Sikorsky H-19 for a large order 14%. Reasons: Military buyers are changing engine configurations for drive and prospective engine customers are likely the price trend must come down. Major cost breakdown maintenance.

Procedures for the major machine tools, temporarily in excess of requirements, are averaging about \$200 per inch. Navy Bureau of Aeronautics reports.

Average cost for Navy aircraft engine overhauls, including piston and jet engines, is \$20,144. Navy will overhaul 9,112 engines in fiscal 1954 and has programmed an overhaul program of 11,523 for fiscal 1955.

USAF received about 1,200 aircraft from its inventory during 1953. Removal of the bulk of these aircraft was the result of salvage and surplus. Others were transferred to schools for instructional purposes.

Alt. Force is seeking about \$35.6 million for fiscal 1955 to test 29 flight simulators. Cost of a B-52 simulator is \$981,000. F-100 simulator costs \$368,340.

Approximately seven years is required for the development and initial production of a reliable plane, according to Maj. Gen. O. S. Fisher, USAF assistant for programming.

Aviation Advisor

Mr. Gen. William B. (Pete) Rietz, Deputy Assistant to the President, is competing as a White House expert on aviation matters. He is being asked upon increasingly by President Eisenhower for advice on aviation. An Army general, he was graduated from the Air Corps Liaison School in 1938. A few years, Brig. Gen. John W. Freeman, is assigned as Air Force Deputy Director of Personnel Procurement and Training at the Pentagon.

Pacific Spotlight

The Administration is looking increasingly toward the Pacific theater in defense planning. This year's budget and program forecasts \$500 million for aircraft for this theater, compared with only \$12 million last year.

Defense Department comptroller, Assistant Secretary W. J. McNell, will be in the Far East studying the situation with Japs, when he returns to draw up the fiscal 1950 defense budget. McNell was assigned by Defense Secretary Charles Wilson to investigate Gen. James Van Fleet (USA Ret.), who is returning the Pacific theater in personal representation of the Joint Chiefs with ambassador rank.

Regulation Change?

Indications are Civil Aeronautics Board may attempt to amend domestic Civil Air Regulations to permit 121 flight time limits for single engine crews as permitted in the international CAR.

Nine years from American Airlines' difficulty in keeping within the present eight-hour limit on its worldwide roundup Douglas DC-7 routes coast flights. CAA Administrator Fred B. Lee has given American a 121-jet 1 (Variations Week Air, 36 p. 18) to meet it one month the flight in the scheduled 7 hr. 55 min. 30 sec. of the time.

Look for Air Line Pilots Assn. to request a public hearing should CAA seek to amend the domestic regulations.

ATA Wins Fight

Air Transport Assn. has won its battle to obtain extended longer hours at Washington National Airport. Project limits expire May 15. Originally, CAA Administrator Fred B. Lee wanted to limit facilities on a month-to-month basis (Variations Week Air, 36 p. 30) in view of the proposed regulations to incorporate the airport.

Airlines balked at such a move and Lee reversed his original plan. Recognitions to draw up rules that three hours from between the airlines involved and CAA began work. Chief difference in the new rules is expected to be higher rental rates. If the airport is incorporated, these issues will be assumed by the corporation.

Air Review Completed

When House staff is reviewing the Air Coordinating Committee's interim plan, review is at hand reports with Budget Bureau handling the details. The review, in preparation since last September, was headed by the White House's chief of staff of the May 1 deadline. A confidential informant on committee problems may be sent to the President later.

Navy Information Reshuffle

New Navy information group brings in Rear Adm. William G. Bessler as Navy chief of information in Japs replacing Rear Adm. Loren S. Parks who is being assigned to command the Norfolk Naval Base after a two-year term in information duty. Adm. Bessler, a submarine officer, served as assistant director of Navy public relations for two years during World War II. He later commanded a cruise division in the Pacific. His present assignment is commander of the Middle West Force in the Persian Gulf.

Other reshuffle changes: Capt. Carolyn Selby, also a submarine, replaces Capt. Slaton Carter as director of Navy public information. Capt. Selby now is attending the Industrial College of the Armed Forces and commanding a submarine in the Pacific during World War II. Capt. Carter will join the Atlantic Fleet submarine force.

Capt. William B. Gifford, Naval mine war instructor at Hawaii, will take over as director of fuel bureau from Capt. Louis Kane. Capt. Richard Lane, of the 12th Naval District Staff, San Francisco, will become director of the civil affairs division, replacing Capt. James Weller.

CAA Study

Commerce Department now expects to release the \$101,900 information study being made of CAA by George McCannick and Foyat, a New York firm, by May 15 (Variations Week Air, 36 p. 18). McCannick has labeled the study "to complete work of study" and some members of the Senate Appropriations Committee are skeptical of the usefulness of such a study.

USAF Academy

Observers say further indications of Air Force efforts to direct its construction program (Variations Week Air, 36 p. 17) in Secretary Wallace and that he would select an architecture-engineering firm to produce a design for the new academy.

The Air Academy Act, which provides \$125 million for land acquisition, planning, design and construction, authorizes the Secretary to perform the work by contract or otherwise, as he deems appropriate or desirable.

USAF has construction is handled by the Army Corps of Engineers and award procedure is to have design prepared under Army Engineer supervision. An engineers' project office under the USAF Assistant Chief of Staff for Installations will gather information on design desired to be considered for the work.

Indo-China Switch

Eisenhower Administration, which was on the verge of armed intervention with U.S. forces in Indo China only a few weeks ago, now is turning away from committing actual troops to that conflict.

The Administration leaders, including Defense Secretary Charles E. Wilson, last week were emphasizing publicly that U.S. jobs was to furnish the French with money to pay off and shoot at actual military forces. Meanwhile, USAF troop carrier C-119s were preparing orders to transport 10,000 of French troops from Europe and North Africa to the conflict zones in Indo China.

—Washington staff

Comet Debut Stuns British Aviation

U.K.'s Best Bet Becomes Its Big Liability

- BOAC, de Havilland face major fiscal problems.
- Impact of jet transport crashes could hit U. S.

By Stockholm Staff
(McGraw-Hill World News)



LAST BOAC COMET to come home following ground order leads into London Airport.



GROUNDING COMET results late at London Airport as investigators probe crash causes.

London—Nearly all new airlines here their starting troubles, but only one British today and he'll say the Comet is having a lot more than its past share of bad luck.

These troubles go far beyond for more or less routine problems of finding out why Comet 1, the world's first commercial jet transport, actually has developed a tendency to disintegrate. They not only are the cause of major shifts and rearrangements in British aviation by both producers and operators—but could have a considerable impact on the U.S. and on jet propulsion in general.

►No Flies—Today, nearly a month after the Stouffville crash and more than three months after the Elgin disaster, investigations still have not at the slightest hint of the cause (see story).

There is a general consensus that the same thing and one thing only—a combination of heat or over-stress of both engines—also may have been the cause for the Colombia accident.

Meanwhile, the Comet, once British aviation's greatest prestige symbol, now is its greatest liability. Its airworthiness certificate has been withdrawn (Variations Week Air, 36 p. 16), and

British Overseas Airways Corp., which had built its future upon the Comet 1 and 2, is seriously reorganizing its operations now, from it now have to buy more U.S. in Canadian equipment to fill the gap left by the grounding of its own remaining Series 1s and the inevitable delay in delivery of the 12 Comet 2s on order.

►The de Havilland Aircraft Co., designers and manufacturers of the ill-fated aircraft, does not know where to turn next. With 15 Comet 2s in various stages of completion, all work has been halted except on two raising the flight test stage. Unlaid millions of

dollars in operating capital face a most uncertain future. It is possible that if the crash comes are not found and remedied soon, the company will be in severe financial trouble.

►Other British producers, like Vickers Aircrafts with an V-1000 jet transport, cannot but wonder what all this means to them. Adding further to de Havilland's troubles is the decided possibility that some orders for Comet 3s may be canceled.

►New Production—There may be a huge lesson to be learned as jet aviation in general, when (and if) the crash causes are determined. Hereafter, these events give new impetus to designers

who argue for and against external pool mounts for the engines.

But the reason may go deeper than that. The Comet 1 is unique in at least one aspect. In 1949 and a half years of operation, British airlines as it has gained more losses per aircraft than probably any other class of jets in operation—more \$150 per aircraft. Thus, the possibility remains is raised that whether caused the two Rome accidents may be basic to jet aviation—new phenomenon that comes to light only after a great many hours of actual night operation.

►Filling the Gap—BOAC is not sure it can get out next year of money for new jet-type aircraft and still hold its Comet having schedule. It is now in serious financial trouble—22 September, 11 Concorde, 10 Stratoscander and one Comet 1s—cannot meet current state commitments with the Comet 2s, even after switching some Argents from the South American route.

Thus, it appears virtually certain BOAC will have to buy at least additional equipment, not only to replace the Comet 1s but to fill the gap left by the Comet 2s scheduled to be delivered this year. Some estimates are that it would require twice as many new jets.

Effects are being made to speed up

707 Flight: June

Boeing's prototype 707 Stratoliner jet turbo-propeller now is expected to fly in June—five months ahead of scheduled-company tests. William M. Allen has told stockholders. Rollout of the jet Stratoliner, which will have an unusual ground attitude, according to a source inside the company, will be this month.

Transportation Corps aviation field service officer, who will discuss the importance of increased service life and how it can be used to its best advantage.

• **Capt. Melvin G. Connel**, commander of a helicopter maintenance company at Ft. Bel, Okla., will tell about the difficulties experienced in the field and make maintenance design recommendations.

• **Donald M. Thompson**, chief of engineering and development branch for the Transportation Corps' Air Transport Service, will demonstrate that the most significant feature of a helicopter is availability and more emphasis should be given to this than to speed in its ground payload.

• **Industrie Straker**—The helicopter industry, represented by accessory and parts manufacturers as well as major engineering partners, also will participate in the proceedings at the St. Louis meeting.

Some of the speakers and their subjects:

• **William Wiseman**, chief engineer of Continental Motor Corp., will present a study of low-power and high-power operation on the life of the engine.

• **Dr. Arthur Nutt**, Licensing Specialist, will speak on "Matching Powerplants to Helicopters."

• **Wayne T. Colwell**, General Case Manufacturing Co., and S. W. Bantz of Douglas Engineering Corp., will speak on transmission problems.

• **Richard S. Hoefler**, Passaic Aircraft Corp., H. W. Bonnett-Skinner, Robert L. Eichen, Bell Aircraft, and a representative of Pratt & Whitney Corp. scheduled to speak on rotor blade problems.

• **Richard Carlson**, of Hiller Helicopter Co., will discuss the design of transmission for 1,000-hp life.

• **Frank N. Pomeroy**, board chairman of Pomeroy Helicopter Corp., will deliver a paper on the "Design of a Complete Helicopter to Give a Service Life of 1,800 Hrs. Between Overhaul."

• **Joe Callaghan**, chief engineer and operations manager of New York Airways, is scheduled to address a discussion meeting on the experience of his company with maintenance of the Sikorsky S-55 in commercial service.

The symposium will open with talks by Maj. Gen. Paul F. Yount, Army, chief of transportation, and Brig. Gen. A. T. McNeam, chief of the Supply Division, G-4 (logistics).

Among companies invited to send representatives to the St. Louis meet are: Sikorsky, Bell, Pratt & Whitney, Hamilton, Products, Cessna, Avco, Dornier, American Helicopter, Douglas, American Corporation of Texas, Fairchild, American Cir. & Propeller, Lockheed, Goodyear, Bell, West, Piper, Hughes, Inco, Bell, Ryan and de Havilland.

Aircraft Workforce

Employment in the aircraft industry was 773,620 in January 1954, an increase of 49,200 from the same month last year, a Labor Department study shows.

Number of production workers was 579,500 in January 1954, compared with 530,700 for January 1953.

	In thousands	Jan.	Jan.
Industry group	1954	1953	
Aircraft	579.5	447.3	
Aircraft engines and parts	146.6	138.3	
Aircraft propellers and parts	16.5	34.3	
Other aircraft	121.9	99.2	

Nike Batteries

• **First of 40 installations is started in Washington.**

• **Air cover spreads over area estimated at 25 mi.**

The first of about 40 Nike anti-aircraft missile launching units is being constructed now in the Washington, D. C., area and is scheduled to become operational this summer.

Fourteen critical defense areas currently are listed to get Nike defense. Norfolk, Va.; Washington-Baltimore, Philadelphia, New York, Boston, Pittsburgh, Cleveland, Chicago-Detroit, Colorado Springs-Denver, Hartford, Wash., Seattle, Los Angeles, San Francisco, and one unnamed site.

West Coast states report Army has announced Los Angeles will get the second Nike installation, with preparation of launching sites already under way.

All sites are to be constructed within the next two years under a program holding priority over all other Army construction, except that allotted to

'Soapbox' Back

With this issue, Engineering Forum resumes its "Aviation Week." Originally a sounding board for engineers' opinions, forum now has been widened to its scope to serve as a showcase for ideas of technical men. First of the new series begins on p. 48.

certain critical acquisition manufacturing projects.

• **Battery Details**—Nike is a surface-to-air missile developed by Bell Telephone and Douglas Aircraft, currently being built by Douglas under an Army Ordnance contract (Aviation Week Mar. 15, p. 78). Rocket-propelled and expensive, Nike has a diam. range of about 33 in.

Several sites will be located around Washington to provide an air cover estimated at 25 mi. diameter and 60,000 ft. high.

Two major units, separated by at least 1,000 yd. but no more than 30 miles, make up a single Nike site. The launching area contains everything necessary to assemble, test, fuel, store and launch the missile; the control area contains all the radar and power equipment.

Underground magazines contain missile storage space and firing controls. Missiles are moved out of the magazine in a horizontal position on a special launcher. They are raised to the surface by an elevator while simultaneously being craned to the vertical for firing. At the end of the Nike effort can be fired immediately from the elevator platform or moved to launching rails which extend from either side of the elevator position.

• **Typical Site**—A launching area is roughly T-shaped and contains about 200 ft. along each side. Along the top of the T are the missile assembly, test facilities and firing area.

The control area is built around three sides for acquisition, target tracking and missile tracking. Power supply, space parts and other equipment are located at the site.

Judging by the layout of the launching area, missile components are delivered by truck to the assembly and test building. There apparently is a strict dress code at most of the buildings for a perfect check of the acid-pollution meter of the Nike.

Nearly is the firing point for the missile, and further on behind earth berms is the acid loading station.

Also facing Nike are wheeled to the elevation on special dollies and stand in the underground magazines.

Two launches comprise a single Nike battery, and increased strength is equal to 48 officers and enlisted men per battery. Current plans are to have the number of batteries assigned to a given defense area in accordance with the weapons/air and population density of the site. Maximum number of batteries to any area will be four which means only eight launches, if conditions demand it, each battery can be expanded to handle six launches each month of the annual two.

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Future Pattern of Passenger Movement Intercity Common Carriers (Estimated 1965)

Market Group	Mileage, Mi.	Railroad	Bus	Plane	Ship	Total
A and B	3,100	84	235.5	97	28.6	379.3
C	100-1,000	16.4	32.6	4.4	15.2	70.6
D	100-1,000	15.9	11.7	8.8	6	37.9
E	100-1,000	48	1	8.4	8	66.2
F	100-1,000	5	1	1.3	0	6.8
G	100-1,000	4	1	3.2	0	8.7
Total	14,540	145.4	281.5	121.5	50	599.3

*Note: The estimated 1965 passenger mobility will reflect intermodalization in the form of "intercity" services between airports and the major business centers of respective limited cities.

ATA Project Director Says

Airlines Face Critical Decade

The next decade will be critical for the airlines because they will approach saturation of the longhaul passenger market—fully principal source of income, says Clarence H. Aldrich, special project director for the Air Transport Association Research Division.

During the past few years particularly, the airlines have achieved most of their traffic accretion within the 1,000-mile-plus longhaul market, this despite the fact that during the past three decades the proportion of nonair-circular travel has increased while specified markets has remained relatively constant.

► **Road Growth.** This means, Aldrich reports, that the airlines have been eating into the market faster than the population has expanded. In 1953, the airlines achieved a record 72% penetration of the 7.1 million nonair-circular passenger traveling; more than 1,600 air, he notes.

Further growth in this field depends upon population increase and acceleration of the national revenue and those discounts have shown, a "constant rate of movement," estimate closer than the rate of growth achieved by the airlines, he notes. By 1965, Aldrich says, the airlines will achieve only "a slight gain" in longhaul traffic penetration—reaching 82%. When the airlines reach this point, they no longer will be able to capture additional longhaul nonair-circular traffic at a rate comparable to the past, Aldrich says.

► **Traffic Trouble.** Noting the big point is air travel that will be made with the use of transport helicopters, Aldrich sees a problem arising from the entrance of rotary-wing and fixed-wing operators at major airports in the U.S. In 1965, he predicts a total of 1,475,000 takeoffs involving fixed-wing and rotary aircraft at these terminals will be predicted.



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Existing Pattern of Passenger Movement Intercity Common Carriers (1955)

Market Group	Mileage, Mi.	Railroad	Bus	Plane	Ship	Total
A	3,100	84	235.5	97	28.6	379.3
B	100-1,000	16.4	32.6	4.4	15.2	70.6
C	100-1,000	15.9	11.7	8.8	6	37.9
D	100-1,000	48	1	8.4	8	66.2
E	100-1,000	5	1	1.3	0	6.8
F	100-1,000	4	1	3.2	0	8.7
Total	14,540	145.4	281.5	121.5	50	599.3

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► **Potential.** Midsize—qualifying the markets susceptible to future diversion to the airlines, Altech uses five groups bracketed by mileage.

• **Group A—Less than 50 mi.** This, the largest of all markets, creates entirely markets in terms of routine passengers, is out of the reach of airlines using present equipment and schedules. Less than 100,000 out of 256.5 million passengers in this category used air transportation last year.

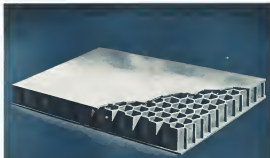
• **Group B—51-250 mi.** Most of the 171.1 million passengers fall in this category. Last year the airlines carried five out of each 100 passengers, but nearly half this traffic moved between Washington-New York and Boston-New York.

True advantage of air travel "is high marginal" schedule flexibility in "the fleet" and the convenience of two



Scorpion Scores

Since top wings of Spica setting, a hot road trail, some good and a wider reference (as ground at left) all that results of a 6 ft x 30 ft, two height after a lot by rockets fired from a Northrop F-90D Scorpion on target practice. Less than a third of the normal complement of 104 2.75-in. hollowing subsonic rockets carried on the Scorpion's weapon pods were fired in the year that has the target to hit. Examining the remains, left to right: Capt. James H. Han, Edwards AFB project officer; Northrop test pilot Clarence Frank, Jr., Northrop flight test engineer; J. Wallace and Hughes Aircraft technical representative Peter Leckman.



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increase trips per flight is "too much effort" for most passengers, Albiotti says. But the market must be retained as an active engine potential. Albiotti says that many airlines already have, provided airports are established in the same general area now occupied by major bus and train terminals.

Group C-Between 215-300 seats. The air carrier has expressed a higher percentage of the market—if they acquire their dependability and frequency of flights. Airlines have generated a "re-spectable" 25% of the market but could, in other words, get a portion of the 25 million aircraft passengers who have not yet chosen to use airplanes on these distances.

Group D-300-1,000 seats. This group offers a great potential for growth to the airlines. Thus far a 57% passenger has been achieved, with increased flight frequencies and the present equipment acquisition schedule, airlines could have this potential to nearly 80% by 1965, Albiotti believes.

Group E-More than 1,000 seats. This is the market that has most "stuck and is much faster" to the airlines daily fleet, but the future outlook in that growth in the field will be slight, depending on population and income increases.

Talbot Calls USAF Planning 'Flexible'

As Force planning for 137 wings by June 30, 1965, is based on a "flexible DAP," USAF Secretary Harold G. Talbot states in a report on the first six months of fiscal 1964.



"We are retaining a high degree of flexibility in our planning action to insure more rapid adjustment to changes in the world situation," Talbot says. His program provides a firm base and a goal which can be studied as a schedule. It also provides a force structure designed to be maintained over a long period of time."

USAF Policy-Talbot also outlines USAF national strategic policy. "The Air Force has modified its broad industrial base policy by the assurance of a production reserve policy. This is a policy for the establishment of an industrial structure which will insure the availability of equipment and, at the same time, give us the flexibility that the rapid technological developments in the aircraft industry demand."

Under this policy, duplicate sources for equipment which is ahead of schedule have been phased out and, in some cases, a second source has been established in order to maintain adequate capacity for replacement needs. Production sources are established and operating, and, accordingly, it has been possible to reduce significantly the critical lead time factor.

"The production rates contemplated will give us a better balanced program and make for a more transition from existing plans to replacement rates."

Talbot's emphasis-Defense Secretary Charles E. Wilson reports the first 1965 budget marks the first impact of the revision of strategic plans on Defense Department's military program.

It places increased emphasis on the development of weapons, both Air Force and Navy, while continuing the

Italian Sportplane

First photos of new Helios Aerobus 1.7. Kauder three-place personal plane, powered by a 90-hp. Continental engine. It is single landing gear is electrically retractable. The cockpit doors fold down rearward and VHF radio installation on right side. Dual controls are fitted. Talbot's three fully loaded is given as 693 lb. Range is 160 mi. As early version of the Kauder, the F-4, was of all-wood construction and named after A. Kauder & Co. in Lombardy in Milan.



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Fig. 1 Jet Hydroform Operation



Fig. 2 Jet Hydroform Operation

A leading supplier of jet engine parts, Cockshutt Aircraft Ltd., Brampton, Ontario, Canada, is obtaining many production economies by Hydroforming a variety of engine components that would be costly or difficult to produce by conventional methods. Two Cincinnati Hydroforms of 12" and 30" capacities are employed. The part shown in the photograph above and in Figs. 1 and 2 is typical of the work produced by Hydroforming.

Frequently Cockshutt finds it advantageous to combine Hydroforming and mechanical pressing to produce a drawn part. They report the following benefits are obtained from total Hydroforming and from combined Hydroforming-mechanical press drawing:

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- The metal is displaced rather than stretched into shape.

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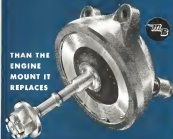


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modernization of land and sea forces and maintaining them at a personnel level somewhat lower than during the Korean conflict," Wilson says.

His report states the estimated expenditure of \$17.6 billion during fiscal 1977 will be no higher: 1978 by USAF, 28% by Navy, 27% by Army and 2% for miscellaneous activities.

Directive Sets New Progress Pay Policy

Progress payments to defense contractors with long term contracts are considered substantially necessary, when precluded percentages, without regard to the contractor's ability to borrow, Defense Secretary Wilson has ruled.

A long term loan, called for by the bulk of the annual contract's defense contracts, normally approximates six months between the beginning of work and the first delivery.

Lengthy fixed-fee—disposable contracts can allow progress payments on the type of contract in which cash payments have been traditional without involving percentages of cash receipts and expenditures or other demonstration of need for progress payments, the Wilson directive states.

Both production and research and development contracts, where progress payments are based on costs, are affected by the new directive. The directive (No. 7049.1) cancels a previous order, dated Feb. 15, but without payment limitations of 75% of total costs or 90% of direct labor and overhead costs (Aviation Week Mar. 1, p. 10).

Percentages over the specified standards require special approval and demonstration of need including non-availability of borrowing. With such special approval and demonstration of need, the directive also may be provided in exceptional cases if periodically expenditures in a contract's particular circumstances will be kept in relation to the contract type and its working capital and credit.

Payment Formula—Standard rates for liquidation of progress payments are precluded, Defense says, so that a contractor who receives 75% of all costs, as in progress payments, will receive no more than 25% of the contract price of items as they are delivered until the advance has been approved from the contract price of delivered work.

The directive says progress payments will be discouraged on relatively small contracts of the larger contractors such as order backlog less than \$1 million to minimize administrative effort and expense. It applies to new prime contracts, however, for all contractors, in changing existing contracts.

The directive requires progress payments

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Air Temperature - 60° F
Dew Point - 55° F
Wet Bulb Temperature - 58° F
NO FOG
Air Temperature - 60° F
Dew Point - 55° F
Wet Bulb Temperature - 58° F

In general, in estimating fog conditions, expect no ceilings with winds less than 5 m.p.h. Expect a ceiling when winds are 10-50 m.p.h. An important exception may occur when sea fog blows inland over a cold land area with strong winds and very near ceiling.



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NOTE: The MYCALEX glass-bonded mica materials described above, are all Glass Reinforced and are manufactured with the Mica-Mica Corporation of America.

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ments to be paid promptly when awarded and billed in accordance with contract provisions, as the absence of prompt payment, interpreted as non-satisfaction performance, without regard to a contractor's actual need for funds at the time.

Periodic Evaluation—Progress payments require careful administration to insure against overpayments and losses. In all cases the physical progress of the work should be evaluated periodically to insure that the progress payments are fully supported by the value of the work actually accomplished on the undelivered portion of the contract in conformity with the contract requirements, the directive states.

"Also, the unliquidated progress payments should not be permitted to exceed the percentage specified in the contract of the costs forming the base for progress payments, applicable cash to the partially finished undelivered portion of the contract."

Management Factor—"The extent of experience required, whether for less protection or for avoidance of overpayments, should vary inversely with the experience, performance record, reliability, quality of management, and financial strength of contractor, and with the adequacy of their accounting system and controls," Wilson's edicts say.

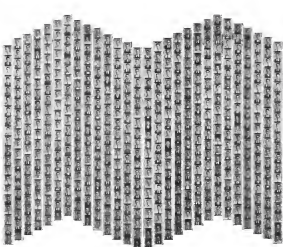
Review should be of a kind and degree that will be sufficient, consistent with the circumstances of individual cases, to provide timely knowledge of contractor performance and the liquidation of progress payments, and thereby opportunity for any action that may be appropriate for the protection of the government. "Preliminary one must be taken to insure that the agreed balance of the contract price will be adequate to cover the entire paid cost of completion, or that the contractor has adequate resources to complete the contract if the agreed balance of the contract price is inadequate to cover costs of completion."

Additional directives are placed by the Defense Department to deal more comprehensively with progress payments, particularly those based on percentages of physical completion of the contract.

Three Aviation Firms List Top Salaries

Three aircraft companies report these salaries of 1973:

Boeing Aircraft Corp.—H. M. Haeber, president, \$187,643; Leonard S. Hobbs, vice president/engineering, \$177,500; Frederick B. Bantelbach, board chairman, \$175,515; and William



you are looking at 560 electronics engineers

This concentration of manpower—the equivalent of nearly 4,000 years of experience in the new science of electronics—is part of a team of 2500 specialists in the Engineering Division of Martin. It is also part of a major development in the aircraft industry.

For the electronics requirements of today's weapons systems are an increasingly critical factor in the cost of power, involving navigation, guidance, search, fire control, communications and a rapidly growing number of operational functions.

Martin's top-rated electronics resources are a vital part

of the balanced and integrated system of engineering skills essential today in the production of optimum weapons systems at maximum efficiency and economy.

Take the case of the U.S.A.F. B-41 Navaho, America's first successful pilotless bomber.

This major weapon is being produced for a fraction of the cost-per-pound of equivalent piloted aircraft—another long-range payoff on Martin Systems Engineering, which is delivering more airpower at less cost to our Government and the American taxpayer.

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R. Babbar, vice president-controller, 5111-079.

Republic Aviation Corp. Moody J. Fode, president and general manager, 5114-018; John J. Ryan, vice president, 5113-994; Alexander Kerkov, vice president-chief engineer, 5113-891; **Forchuk Engine & Airplane Co.** Richard S. Boswell, president, 5113-436; Arthur F. Flood, executive vice president-controller, 511-414; and Clifford E. London, vice president, 515-736.

H-Bomb Touches Off Australian Air Buildup

(McGraw-Hill World News)

Melbourne—A new look for Australian defense forces with sharply increasing emphasis on defense is in the making, according to informed sources here. These key factors have led to important changes in policy by the federal government.

• Impact of hydrogen bomb development.

• Recent outpouring criticism of Australian defense policies by An Vite Marshall J. D. L. Hancock, serving chief of the Royal Australian Air Force.

• Considerable pressure by Allied and Australian experts who have been advising the government to pay more attention to the air force at the expense of ground and naval support.

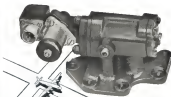
• Millions for Bombers—At least \$60 million is slated to be spent on heavy bombers for the RAAF within the next two or three years. Australian purchasing officials have been thinking in terms of British types, such as the Avon Vulcan or Valiant Valiant. Should they be difficult to obtain, U. S. aircraft may be ordered.

Once defense allocations are decided, orders for other new types also will be given high priority under the new plan to make aviation Australia's principal military force. Air force personnel say further Lockheed F-104 Nightstars should be purchased. Australia's present fleet of Nightstars turned in an "extraordinary" performance during recent exercises.

Additional orders for Australian built Canberra jet bombers and F-4 Phantom fighters will depend on speed of deliveries of ordered planes and their economy.

• **Training Problem**—The RAAF is having trouble training needed personnel. The federal government expected the air force to get some 10,000 trained seven thousand, but the RAAF received only 5,500 and was unable to handle them.

It is possible that orders for additional training equipment will be placed.



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The generator pictured on the opposite page—for a new jet aircraft—is one of several models that have been undergoing steady development since 1949, based on the proven theory that combustion is the most economical and efficient method of supplying large quantities of start gas for aircraft protection.

The Janitrol unit weighs less than 50 pounds—occupies only 3 cubic feet—produces more than 10 lbs./min. of start gas for complete, passive, explosion and fire defense from "catalytic" causes as well as enemy action. The pilot need fly only one switch to start the generator into operation, from there on operation is automatic and continuous. Generated gas is dumped overhead, and the proper degree of "inertness" is established, from the gas is supplied to fuel cells and surrounding areas on a demand basis—

determined by pressure—continuously, until the generator is shut down by the pilot. Even after shutdown, there is an automatic "purging" action within the generator to assure that all fuel is exhausted from the generator system, and that all volatile vapors are cleared out before operation again automatically.

The versatility of Janitrol's new "double-plus" heat exchanger principle permits construction of generators in virtually any configuration to meet installation requirements on planes, as well as custom aircraft.

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37 years experience in combustion engineering



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SKIFFITED CUS can be hoisted on small wooden raft, needs only low forward speed to stay on surface of water. No flotation is built into airplane. Test pilot Joe Busley shows handoff stability of the winged boat powered by All American jet fuel.

Target: Breaking the 'Runway Barrier'

Helping aircraft take off or land in minimum space ranks high among projects of All American firm.

By David A. Anderson

Wilmington, Del.—"Breaking the runway barrier" is a phrase that the All American Engineering Co. staff use informally to describe one type of engineering work they tackle.

Most of the problems in the company's development will have to do with getting aircraft on and off the earth's surface in minimum distance for maximum cost. "The runway length situation is getting out of hand," says AAE vice president Robert Gottschalk, "and we're trying to help the aircraft and engineering people do something about it."

That something—which started back in 1955 with glider and jet mail pickup schemes—now includes special types of landing gear and airpumps, and a different, pioneering approach to hydrofoil design: the "hydrofoil" system in which the airplane can enter in a transition fashion between a small land wheel and flight.

In other fields, the company has engineered a new approach to instrument lighting, an engine test house, an airtransportable rooming unit for blimps, and lightweight, high-power motor for lighter-than-air craft and balloons.

Policy Statement—"Our policy is to

translate ideas into developed and tested hardware," says president Charles Wendt. "Readiness can come to us with a problem and we will come up with the solution, engineer the design and build and test the hardware."

Although the company specializes in research and development, it is set up for small-scale production, says Wendt.

Basic field of All American activity is aviation, but company policy calls for expansion into other fields. The staff believes there is considerable potential for growth—it knows of no other company doing a similar job.

"Our work load is quite high, but don't mean work availability," says Wendt. "We're actively recruiting and expanding."

Behind the growth of All American is a group of young engineers. Vice president Gottschalk and Donald Doolittle are 34 and 34 years old. Raymond Janczy, chief engineer, is 32, and all senior project engineers are that age or younger.

Started in 1955 to develop air pickup techniques for local mail service, the firm expanded its ideas into systems which stretched aviation photos off the fields of England for the invasion of the Normandy coast 10 years ago.

Today AAE works on more than 40 different projects, most of them under the sponsorship of Navy's Bureau of Aeronautics.

Hydro-Lift Airplane—All American has jumped into the problem of water-based aircraft up to its landing gear—



ALL AMERICAN ENGINEERING CO. shop and offices at its Fort Airport, is seen from the air. Wheel space lounge at extreme right is AAE's "testhouse" for low Airtransportable blimp carrying most a spread out in front of hangar.



Good Management— key to America's defense ...

... and good management is the key to AC's ability to turn out many of the electro-mechanical marvels which guard America's shores.

Through good management, engineers with the necessary training, experience and imagination can be used to best advantage. It takes good management again to provide these men with the specialized equipment and facilities they need—when and where they need them.

That kind of good management can build a "team-

ing instinct" into aircraft shells—as AC is doing in the T-38 Skywarrior Fire Control Systems. AC is building pin-point accuracy into Gun-Rocket Sights that are modern classics of engineering and design.

AC is always looking for new problems in this field. If you have such a problem, good management may be the answer—and the "know-how" and experience of more than 700 AC engineers and scientists are at your service.



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PRODUCTION ENGINEERING



3-D...in production...has an important production engineering role at the Fairchild Engine Division. Scaled-down depictions of the big production lines are countless dollars and months more born...make possible complete pre-planning before actual production of turboprop engines, auxiliary powerplants and other power products begin.

Many of blueprints for new finer plans are eliminated. Instead, technicians simply arrange scale models to arrive at the most efficient production layout. Then, actual plant layout is set up to agree with the scale layout. Advanced techniques like this are a part of planned production engineering at Fairchild...peaking efficiency up and criss down on major projects for all the Armed Services.



very unusual landing gear which can be adapted to a land-based airplane.

The AAE looks like a small remote-controlled plane of water and can be attached with minor modifications to the landing gear legs of a land-based craft. There is an extra landing built in or added to the airplane. The whole package is a little below the lower surface of the air, so that the plane can take on the ground or in the small landing that serves as its water base.

Takoff starts on the landward, which is the company's test was a self-the USS Baltimore—anchored in Chesapeake Bay. It was about 100 ft long. The aircraft ran along the left and by the time it has covered a distance of about three to four times its own length, it has reached a speed which will let it place on the water surface.

It continues to plane until takeoff speed is reached.

Landing is reverse, with the pilot continuing to run across the water and up on the left. The company says that with a little practice the pilot can stop with a ramp run of about two airplane lengths.

All American's pilots have made thousands of landings and takeoffs from beaches, harbors and ramps in a research program conducted mostly by the Navy in a group of several airplanes. The largest was the standard SNJ-5C Navy trainer, but company engineers say that there is no reason the gear couldn't be adapted to an airplane of any size.

Facilities—All American's offices and shop buildings lie in one of the red runways of the Fort Airport at Washington. About one-third of the complex are steel plants, they can walk out at the door in spring, time will take off within a few minutes to log some flight time before again.

The factory has about one of every tool needed in metal craft shops of the black-and-white lines of engineering drawings. Precision machines cover floor space with benches for hand work, and there are two small, but carefully equipped machine shops.

In addition to the Fort airport space, All American has leased about 100 acres at Sussex County Airport at Georgetown, Del. That airport is a former Naval air training station and has three main concrete runways.

A third facility is at Chesapeake Bay, and is used for the company's hydrodynamic tests.

Among special facilities, All American maintains a small wind-tunnel now doing cascade airfoil research, a jet engine test stand, and a "combustion" testing tank for tests of water-based engine models.

Inspection Services—The "combustion" water basin might be considered typical of the ingenuity applied to All American engineering problems. De-

Airation Week Picture Brief



TATER CHIP was designed and built by Ned Koenig of Aircraft Repair Service, Fresno, 21, to meet the rugged sport pilot from Steve Wittern. It is 170-cu in displacement class, at cost 285 mph.

Tiny Sportplanes Make Debut

Flare building of aircraft has made modest gains in recent years with an eye on a few recent experimental licensed planes on rugged high performance models. Others appeared Jan 25.



YELLOW JACKET was built by Gilbert and Bruce Pitt, Hialeah, Conn., who, in part, built 15 different planes, including a single seat. Powered by a Continental C85, the 140-cu sport airplane has 180 mph top speed and cruise of 150 mph.



LITTLE AUDREY sportplane was made by Paul H. Folsom, Milwaukee, grad first of Experimental Aircraft Assn., which advocates plane building at small scale. Audrey is derived from Ryan Howard's Fox model, it has a 75-hp Continental, open 17.5-cu, weighs 500 lb and has top speed of 140 mph.

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BAILOUT TRAINER developed by Navy's Special Design Center is 25 ft high, but collapses for easy transport.

Developed for the Office of Naval Research, the tank grew out of the length limitations of the towing buses available at such installations as NACA, the Navy's David Taylor Model Basin or Stevens Institute of Technology. These highly instrumented, accurate test facilities are expensive, they are also limited in test duration by the physical length of the tank.

Some of the early development work with the level-of-flight airplane required long test runs to produce qualitative data rather than the wellpoint test data generally obtained in the more sophisticated facilities.

So All American engineers designed, built and are operating a water towing tank with an undrained test run. It resembles an old-fashioned water wheel, it is basically an open-ended wheel made from a closed circular channel and hinged on one side of the tank only. The other side is open.

To test, the channel is partly filled with water and the wheel is spun. As speed picks up, centrifugal force flings the water into a uniform layer around the inside of the wheel.

Models are brought in the open race of the wheel on a boom and lowered to contact the water. Diameter of the test is as far as long as the wheel is whirled.

In effect, this is analogous to wind-tunnel operation, so the model is fixed and the wind speed means you test the model. It is a "quasi-wind-tunnel" test rig. But if it is a poor model, it will be able to supplement the data of the more sophisticated tests.

• **Rollout Trainer**—Using an ejection seat should be almost a reflex action for a pilot in a crippled airplane. But to acquire the ease familiarity with the seat, a pilot has to practice. Hence the ejection seat trainer, a simulator designed, developed and produced by AE Electronics for the Special Design Center of ONR.

This trainer simulates the seat ejection

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100-2	270	10	2700	115	1	1000	10	1000	2700
100-3	270	10	2700	115	1	1000	10	1000	2700
100-4	270	10	2700	115	1	1000	10	1000	2700
100-5	270	10	2700	115	1	1000	10	1000	2700
100-6	270	10	2700	115	1	1000	10	1000	2700
100-7	270	10	2700	115	1	1000	10	1000	2700
100-8	270	10	2700	115	1	1000	10	1000	2700
100-9	270	10	2700	115	1	1000	10	1000	2700
100-10	270	10	2700	115	1	1000	10	1000	2700
100-11	270	10	2700	115	1	1000	10	1000	2700
100-12	270	10	2700	115	1	1000	10	1000	2700
100-13	270	10	2700	115	1	1000	10	1000	2700
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100-48	270	10	2700	115	1	1000	10	1000	2700
100-49	270	10	2700	115	1	1000	10	1000	2700
100-50	270	10	2700	115	1	1000	10	1000	2700

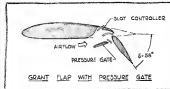
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How to Give Wings More Lift

A series of slotted flap designs which are claimed to produce better lift at velocities as high as 410 is being offered to aircraft designers by Chas. R. Grant, an aircraft test consultant of New Rochelle, N. Y.

Grant, who has been working on the high-lift problem for over 30 years, has just flap designs was used on the Dayton-Wright series in 1915—evolved the present series of flap flap experiments which began in 1935.

Through an unusual coincidence of product development, a Grant-type flap is used on the Martin 404 transport, although the Martin flap was designed by two of the company's engineers.

History

Grant began his development in a series of ground studies aimed at producing high-lift devices. He began with leading- and trailing-edge screens, and with variable-camber wings. But in the early '30s, he began to focus on the idea that the answer lay in curving the entire wing section.

His first flap design in 1934 was a mechanical method of curving the wing. The trailing edge section was divided into five segments, a hinge pulled these down and together into a relatively smooth single curved surface.

Meanwhile Grant had begun what was to be a long and fruitless correspondence with the National Advisory Committee for Aeronautics. After three or four variable-camber ideas in early 1934, he followed through with a report on the multi-segment flap in the spring of 1936. Some of the technical staff at NACA prepared a criticism of the design, pointing out the complexity of the mechanism and the slight advantage of the curved wing.

Thus Grant crossed the agency of the flap to incorporate a series of open slots between each flap segment. The idea behind this was to control the boundary layer over the flap.

A wind-tunnel model of the design was tested at New York University in Jan. 1936. In trend, the flap was 145° chord with four segments.

The maximum section lift coefficient from the tests was 2.64 at a Reynolds number of 10,000, that is higher data values for other contemporary flaps by a good margin, according to Grant.

Lessons Learned

The tests showed Grant some basic parameters of flap design. By analysis, he concluded that two segments and slots was more than enough, and that there as possibly even two would do the job.

Additional research and some flight tests made with models in test flights later showed that two segments worked. So there was the package and Grant had it up with a patent application filed May 1938. The application covered flap design with two down and four segments and the opening mechanism for them.

In October 1938, NACA reported tests on a two-segment flap of about 200° wing chord, which Grant says yielded some of his earlier tests.

Refinements

With two flaps established, Grant turned to refining the flap.

• A series of tests was conducted in a series involving a double-slotted flap. • Six conditions were patented. This "series" contained the flow of air from below the wing.

Grant says that most performance tests at August 1940 with NACA tests of a 95°-segment chord two-segment flap with slight variations from pre-1938 design. Some tests confirmed a lift as high as 5.46 with the large-chord arrangement.

Simplification

Next step was to reduce the number of segments to one. Grant felt this

With the same Section Work introduced Engineering Forum, a further specially patented control system was a secondary based on engineering analysis. Now its function is being expanded to serve as a reference for ideas of technical merit.

In the last article, a consultant's series of slotted flap designs is featured. Subsequent articles will include an experimental program for large-scale, high-speed research, a pair of novel flap design concepts, and an unusual design for a personal application.

Engineering Forum invites your contribution to the state of ideas in aeronautical engineering.

could be done by further work on the slots, and developed a variable-slot one that which provided the answer. In effect, this did the job of the first segment of flap, but did not have to be disconnected from the main wing system to do so. The controller simply rotated a little, and its center moved the air through the slot.

One piece of flap development added a dotted spider to the system, but Grant control as a full-scale application of the flap. Grant recently was awarded a patent on this design, recently received in 1944 and applied for in 1941.

Most recent refinement is a passive hinge gate, added below the wing section where the flap is lowered. The "gate" serves as a guide vane to direct air in toward the slot, between the flap and the wing, and to increase both the volume and quantity of air passing through the slot.

Martin Flaps

There should be a brief explanation of the Martin-Grant flap design in the 404. Two Martin engineers, James McCreight and James Webb, described their flap design in July 1941, and had patent applications for the double-slotted flap on the 404 in August 1941.

The Patent Office ruled on interference between their patent application and one of Grant's filed in April 1940. Grant was recognized in each application, and patents were awarded to both Martin engineers and Grant.

A Martin spokesman said this to use in correspondence with Grant: "The Patent Office correspondence reflects that you state that first invention and we have accepted a license under the foregoing patents."

Grant believes that the outstanding performance of the flap design on the 404—presently built by the Air Line Pilot's Ass. in its platform evaluation of the Martin transport—indicates that it will be successful in a real world environment. He also notes—DAA

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SUGGEST OPERATING CONDITIONS: In recent ground checkout of G.E. J47 engine installed in North American Aviation F-86, 36 hrs. 26 min. engine run time also helped G.E. engines (average J47 service life approximately twenty-five percent).

ALLOWABLE TIME-BETWEEN-OVERHAULS ON G-E J47'S HAS GROWN STEADILY HIGHER



1954
J47 JET ENGINE

Viol to S.A.C. 8-40's and 8-35's, the J47's allowable operating time between overhauls has increased to 1500 hours over the past six years.

Why G.E.-jet powered aircraft today fly FARTHER BETWEEN ENGINE OVERHAULS

Continuing improvement program delivers "more jet engine"
per Air Force dollar . . . Here's how—

By applying past manufacturing experience and laboratory studies, test cell reports and operational data, G.E. has increased the allowable operating time between overhauls of its J47 engines from 15 hours in 1948 to 1500 hours (W.D.R.) in 1954. As a direct result . . .

1. The Air Force now makes more savings in J47 overhaul and procurement costs. Estimated savings on the J47 is alone: \$100,000,000.

2. Availability of G.E.-powered aircraft at U.S.A.F. bases is increased. A S.A.C. B-47 recently logged more than 400 hours without a single engine change.

Actually, all the reasons behind the continuously successful J47 engine program come down to one: General Electric's jet engines constantly seek rock-bottom facts on how to improve G.E. engines—then put the facts to work.

*1948 Service Report

Three thousand design improvements have been made to the J47 since 1948. New compressor blades, whitened vaneless diffusers and give increased engine life. Compressor sealers have replaced ordinary metal liners for longer operating life.

Add the J47's hot-end "hot zone" which protects the compressor from ice particles . . . its new core fire tubes . . . new exit ducts . . . starting turbine shield, new transition lines, shroud fueling nozzles, curved engine valves, re-designed water sealers—these and hundreds of other improvements make up the reason why G.E. jet powered aircraft today fly farther between engine overhauls.

Add progress like this throughout the G.E. engine the world's largest producer of jet engines. Section 240-22, General Electric Company, Schenectady 5, N. Y.

Progress is our most important product

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GEAR-COOLING LINES developed by G.E. increase operating life of G.E. engines and turbine chambers, provide higher temperatures.

LATEST ASSEMBLY METHODS more precise adjustment necessary for maximum engine life, yet bring you installation and production time faster.

CLOSE DAILY CONTROL to maintain exact tolerances of component parts is another reason G.E. jets fly farther between engine overhauls.



Electrically-heated "NESA" glass solves problems of visibility and pressurization for boom operator in Boeing's Aerial Tanker



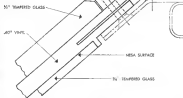
A report from
**THE PITTSBURGH
AIRCRAFT GLAZING
FILE**

A KEY factor in high altitude re-fueling from Boeing's EC-97 aerial tanker is good visibility at all times for the boom operator. A big 31" x 51" window of electrically-heated "NESA" glass assures the boom operator of visibility and handles the pressurization problem at all times.

The window consists of two sheets of tempered glass with a vinyl liner between. Because of the extreme size of the window, Boeing engineers felt it was absolutely essential that the vinyl liner hold the pressurization load if the glass should break. The vinyl used is .007" thick and the bonded layer of glass is 1/2" thick, making both elements the strongest of their kind used in aircraft.

The "NESA" coating conducts electrical current over the glass area, preventing fogging and icing and maintaining clear visibility. The same Plexiglas type of "NESA" glass is used in the seven punch compressing the windshield area.

The accompanying detail shows a



cross section of the lower edge of this large window with the vinyl liner protruding from the two lights of glass to give a flexible, sealed connection with the fuselage. This lower edge is beveled to give better clearance in installing the large glass.

Pittsburgh Plate Glass Company technical representatives assisted Boeing engineers in designing this

installation. You can take advantage of this same level of assistance with your problem, drawing upon the wide experience of Pittsburgh's representatives and the broad selection of glazing materials available to them. For complete information, write to Pittsburgh Plate Glass Company, Room 4238, 602 Fort Duquesne Blvd., Pittsburgh 22, Pa.

PITTSBURGH PLATE GLASS COMPANY

IN CANADA: CANADIAN PITTSBURGH INDUSTRIES LIMITED

PRODUCTION

J & H Breaks Short-Run Production Jam

• Special setup for small orders makes use of tooling shortcuts to speed delivery time and slash costs.

Short runs can play hell with a production shop, cutting costs and raising plant efficiency.

J & H has come up with one satisfactory answer to this problem—a special short-order department. Set up about a year ago in the Cleveland manufacturing, this production setup is logging off about 50% in delivery time and thousands of dollars in tooling costs on orders for 10 or fewer aircraft equipment sets.

• **Still Young**—It was put into operation because it became evident to J & H management that the trend in the aircraft industry was away from high-volume production toward smaller orders for development work. Also, spare contractors wanted faster delivery than the usual nine to 12 months.

Now, the department has 54 production and 11 suborder employees, a total of about 70 men per month with a dollar volume of about \$70,000. Eventually, the department will expand to 100 employees and triple its current capacity, volume, and range of aircraft equipment.

• **Short Cuts**—Space for the new department was found in a portion of Plant No. 1, about five miles from the main plant, but not close to the engineering department, with which the short order setup must maintain close contact.

Machines have been installed for almost every phase of production except gas cutting, grinding, punch press work and boring, which are handled quickly in the main plant, Reilly says.

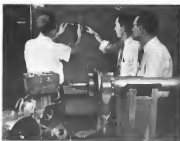
Start outs made possible with the new setup range from slitting paper stock to the heat treating of complex production tooling.

For example, on a particular order for seven sets, production tooling would cost \$53,000, while the temporary tooling used in the short order department costs only about \$5,000. This is a typical case, Reilly says, since average tooling costs for volume production will run to \$60,000-\$70,000, while the temporary tooling costs between \$7,000 and \$7,500.

• **Universal Setup**—One reason for the lower tooling costs is the use of the



PRODUCTION ENGINEER, Andrew Reilly, using parts from Whittier local area as background. With this system, J & H production men can set up tooling quickly, dismantle it fast when job is over.



SHORT-ORDER department personnel check part against customer's working drawing. Instead of taking time to make detailed drawings in accordance with regular engineering method, Short Order works direct from drawings such as these.

Whorton Unspread (pg. 4) and Whorton Systems—a British development introduced in this country a few years ago. The Whorton board contains all the components required to assemble jigs and fixtures.

A skilled toolmaker can assemble a simple tool from its parts in a few hours. When the jig or fixture has served its purpose, it can be dismantled quickly.

With hydrovacuum tooling, it is possible to change a piece in a fixture mass rapidly, but the few seconds saved is not important unless only five or six parts are being made. Reiker says.

► **Skilled Team**—He has a crew of

skilled general machinists picked from the Jiffi factory. Because these men are familiar with all kinds of machines, assembling a spread is flexible.

The short order department doesn't take the time to translate a customer's drawing into the steel detailed Jiffi drawings. Its production employees work from a customer's working print as well as from an engineering or production drawing.

A lesson runs from the engineering department works closely with the short order activity on changes. When a change is requested, the lesson gives it out at longhand, sheets it to the short order department. It is

passed to the drawing and a steel quickly.

About two weeks later, following the steel machine, the final change notice is received. By that time, though, the change already has been made by the department.

► **No Material Delay**—Material is obtained through the Jiffi purchasing department or order from its production plant. Although the short order department has to pay more because it is not ordering in quantity, delivery is faster, Reiker claims.

Cost accounting in the department is simplified, too. All work done on a job is charged directly to the order number instead of the usual method of charging to a job number.

New Inventions

Government Offers Patents for License

New patents issued recently on inventions assigned to the U. S. in the field of aircraft and parts have been reported to Aviation Week by the Government Patents Board.

These inventions are available for license, ordinarily on a non-exclusive royalty-free basis, on application to the agency indicated in the abstract. Printed copies of letters patent may be obtained from the Commissioner of Patents, Washington 25, D. C., at 25 cents a copy, payable by check or money order (change not accepted). Specify patent number and title when ordering.

► HERMETICALLY SEALED EXPLOSIVE CARTRIDGE. Patent No. 2,657,817, issued Feb. 3, 1954.

An explosive cartridge for use in the ejection of aircraft ejection seats comprises a cylindrical casing having a narrowing flange in the head, a breech, a percussion primer, radial air holes and a booster charge. The casing is sealed by burning over the one exposed a resilient rubber ring to make the seal hermetic and airtight. Invention by C. Wilbur Mower and Norman E. Tinsell. Administered by the Office of the Judge Advocate General, Department of the Army, Washington 25, D. C.

► MINIATURE ELECTRONIC TUBE STAGE ASSEMBLY. Patent No. 2,660,791, issued Feb. 9, 1954.

A miniature electronic tube assembly for use in aircraft circuits comprises a U-shaped metal holder on which cylindrical resistors, capacitors and inductors are mounted in aligned positions in the enclosed space of the holder. The holder has a spring clip fast flange adapted to embrace a metal base electronic tube. The edges of the lower portions of the holder are bent inwardly to hold a baseless tube in the tube. Invention by Clarence Stapp. Administered by Patent Council, Department of the Navy, Washington 25, D. C.



Shows EDO jigs and fixtures in EDO

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Engineering data PDA sent on request

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FIVE MAJOR SECTIONS, easily assembled, comprise Ryan's pilotless Firebee.

Fast Field Maintenance Built Into Firebee Jet-Powered Target Drone

How simply can a rugged, recoverable, jet-powered target drone be built?

One answer has been supplied by Ryan Aeronautical Co. with its high-speed, high-altitude Firebee, designed for subsonic and aerial gunnery training, combat plane interception work, and ground-to-air target roles for Air Force, Navy and Army.

► **Single Large Assembly**—Assembled at last assembly in the field and ease of maintenance, the 1,500-lb. drone has a 12-ft. span, 18-ft. length, 6-ft. height. Following a simplified design and production scheme, the aircraft is constructed in five major assemblies including fuselage attachments and self-aligning bolts. This means break-down—fuselage, nacelle, wing, engine mount and tail—permits shipment of the complete target in five containers for a total weight of about 2,500 lb.

In the field, the drone can be broken together in eight more than an hour. Or, the five parts used by same handling equipment.

► **Nacelle Hookup**—The Firebee airplane excludes application of stress, strain, vibration and structural strain. Fueling is a stress-free, simple struc-

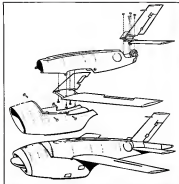
ture using magnesium and stainless steel ducts, aluminum alloy longons and magnesium and aluminum braces.

Lower forward section of the nacelle bolts on to the nacelle, which houses the turbojet and its accessories. Parachute attachment is via four points, with the two forward fittings acting as hinges to allow easy access to the engine without need for removing nacelle from the fuselage.

Nacelle is made up of magnesium skin over aluminum alloy ducts and longons. Stainless steel is used in areas subjected to engine heat. Complete with its turbojet, the nacelle weighs only about 500 lb.

► **Wing Assembly**—Aluminum major assembly is the wing, a single unit constructed at a center and two outer sections fabricated from heavy gage aluminum alloy skin over stress aluminum alloy spars. There are no ribs except at the root and tip stations.

The light-gage magnesium wingtips are pinned to the outer spars to provide for easy replacement in the event of damage from parachute drop. ► **Tail Unit**—Vertical and horizontal stabilizers are fabricated in a single assembly, with magnesium skin covering



BEADDOWN shows how bolts at four-point attachments hold Firebee together.



TECHNICIAN ADJUSTS eyes over to which recovery parachute will be attached.

TO THE

E. E.

ON

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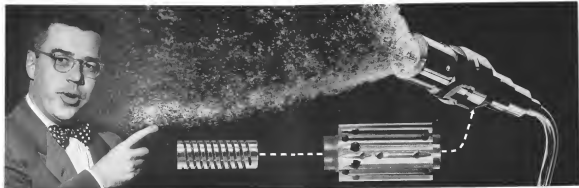
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Spring is machined from solid bar stock to ensure accuracy and reliability.

Insert houses all moving parts. Fuel flows through grooves to split section.

Parker announces new

**Provides excellent atomization . . . quick starts
. . . even operates with contaminated fuel**

"Look at this spray pattern of fuel, evenly distributed fuel particles. It is produced by an entirely new type of fuel nozzle," reports S. A. Rogers, Manager of Parker's Engine Accessories Division.

"Using a single inlet holder, this new nozzle provides a more compact and lighter installation. Dense shape and size of the nozzle body can be furnished to customer's requirements.

"A unique design feature permits this nozzle to operate under contaminated fuel conditions.

"Quick start-up is facilitated by maintaining full fuel manifold. Positive starts have been achieved at as low as 10% of rated engine rpm. High altitude starts can be made over a much broader range of fuel/air ratios.

"Accurate nozzle timing eliminates any need

for expensive fuel system flow dividers. Dispersion of burner temperatures is greatly reduced.

"This new nozzle provides excellent atomization over an extremely wide flow range, yet operates at low fuel line pressures. No appreciable change in atomization is experienced with JP-4 fuel at -65° F. (10 centistokes viscosity). Spray quality as well as penetration can be tailored, over a broad range, to meet customer requirements. You may have a variety of spray shapes, shapes, and angles. Also specific fuel consumption at high altitudes is substantially less.

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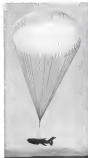
The new standard you save your typing when you switch from manual typewriters to this IBM Electric saves big dollar savings to you.

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*On actual, unenclosed measurements, of both systems of energy use, both systems had equal average energy operation.



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chuteless slow spin. Rate set and only at the top. The vertical fall is a reasonable lay about the ridge, which is attached to the fin with a pair of piano hinges.

The capsule is installed without any low lifts or supports.

Tailfin is a two-piece bearing; its surrounding the parachute that is used in recovery of the drone. Installation of the tailfin plus a few small fittings complete the assembly.

Production Control's contract for the production of the drone was placed last year. The cash first flow in 1953, has been launched from the ground with both mid and zero-length techniques and from the belly and wings of another aircraft.

Currently it is being used in two separate test programs at Holloman Air Development Center. The Ryan test group's research and development program is running completely, while the drone has entered a new phase—operational suitability testing. This is being conducted by an AF operational test center group from the Air Proving Ground Command (Aviation Warfare Magazine, p. 29).

Two Engines—The Fairchild 1,000-horse (H) turboprop has powered the drone at most of its flights, but the cash also has been tested with the J49 Turbojet turbojet.

Continental Aviation and Engineering Corp. has been awarded a production contract to produce the J50 for the Ryan drone.

—Bragg Stone

PRODUCTION BRIEFING

►Clay Multiple Corp., San Gabriel, Calif., is producing a new guided missile component and is enlarging manufacturing facilities to handle the new contract. The firm's investment division has a \$4-million backlog for products such as gyroscopes and searchlight antenna components.

►Lockheed Aircraft Service, N. Y., has received a contract to overhaul 81 Convair F-102 two-engine fighters from the USAF. The New York base also recently received an order from Republic Aviation Corp., N. Y., for installation of Westinghouse B-9 turboprops in an unaltered number of F-34 fighters with work to be completed in early August.

►Solar Aircraft Co., San Diego, Calif., has received a contract exceeding \$6.6 million from Ford Motor Co.'s Aircraft Engine Division covering 157 jet engine components. Work includes case assembly and major "hot end" parts and in addition to previous 157 engines Solar has received from Ford and Pratt & Whitney Aircraft.

►Douglas Aircraft Co.'s Santa Monica Division has been assigned major assembly work on the A1D Skyraider twin jet Navy bomber being produced by the company's El Segundo Division. Eventually Santa Monica will handle planning, tooling, fabrication, assembly and installation of 20% of the A1D and will obtain 450 workers and some 45,000 sq. ft. of floor space.

►E. H. Aircraft Co., Inc., Farmingdale, N. Y., has added a new building of more than 100,000 sq. ft. floor space for manufacture of propellers and engine components.

►Walter Thomas & Sons, Inc., aircraft manufacturer of small craft parts and assemblies, has moved to a larger plant at Storrs Ave., Ridgefield, N. J.



Patch that Passenger

on page 63



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ANS446-1 IR-10M, iron-constantan, plug-in type thermocouple for measuring 0-1000°C temperatures. Also available in copper-constantan and in 50 MCM wire for other material.

ANS446-2 Iron-Constantan plug-in type with copper ring for 10 MCM plug. Wire passed and supporting bracket are stainless steel and induction are protected with flexible heat-resistant sheathing. ANS446-3 thermocouple are silver-soldered to base.

ANS446-4 Iron-Constantan Junction type thermocouple with junction located in silver cup. Spring used with this thermocouple will retain its strength despite high temperatures.

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Interco Castings of Ductile Iron... Produced in Quantity meet jet plane builder's specifications for engine support rings, 31 1/2" in diameter. Sections vary from a thin 1/2" to a thick 2 1/2" in the several states, and modern to high performance standards. Casting references are exceptionally close. Customer rejection averaged less than 1% of castings shipped. Produced by the Interco Division of Ingersoll Rand Corp., Chicago 20, for Pratt & Whitney Aircraft Division, East Hartford, Conn.



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LETTERS

B-36 Controversy

In your recently printed column Jan. 31 (p. 36) you charge that we "vicious and insidious" in our earlier story. The investigation of the crash of a B-36 here. Suppose we reveal your charge and make you retract it.

You say: "Some distributed to George Howard, given by GCA a credit, while black eye." In the first place the George Howard Newspapers had nothing to do with the story. It was not distributed to them since you said. It was distributed to hundreds of newspapers by United Press and Associated Press.

The El Paso Herald Post, which is proud to be part of the 19 George Howard Newspapers, is alone responsible for the story that told the world the news was killed due to an Air Force blunder.

GCA was not given a black eye at you say, but the operation on duty at El Paso from the time of the crash was. Would you not develop a pilot to make a 370 day, from efficient operation? That is indicated by the Air Force.

You say the B-36 "hit a hill" near El Paso! For your information, that "hill" is a granite and limestone mountain 7,200' high, one covered by a large black area where the ship hit and was seen dead.

The report of the USAF is outrageous in what is said by Air Force officials here and by Mr. Nathan Ayman, an information officer in Washington, will nothing about the pilot going down for a look, when you say. Did you know the ship crashed during a turbulence? If the pilot got a complete diversion from GCA is a newspaper, wasn't that enough to confuse him and cause him to try to land visually, rather than wait a ground crew that didn't seem to lose them even only 360 day in a circle?

You say: "There was one operator, not enough, but he was experienced—not a test pilot."

The Air Force doesn't agree with you, except for your statement that he was not a test pilot. The Air Force says there were three operators—a representative of age age 35, with experience since September 1952, a traffic director, age 21, with experience since May 1972, and a first controller, age 25, with experience since September 1966.

There you say by saying: "Most other 'lost' in the strain were ignored." I need upon your own line and I find you have just one brief comment. On all other you are incorrect.

It seems to me that when an editor of a publication receives outside publication of information, he should be able to tell his himself it is not accurate. In this case, you not only missed the wrong party at it, incorrectly, but your accusations were unfounded.

There are facts beyond dispute: A B-36 was coming to be a landing at El Paso Field. From the GCA crew it got no order to make a 370 day and the pilot continued to get other orders, he crashed into the mountain and was seen killed, the mountain in a mile

west of the line, but the country had 28 miles in the air and 100,000 feet.

The Air Force blamed the pilot. He couldn't talk back. As a passenger in Air Force ships, I have noticed pilots make GCA blunders when colliding into at low as 200 ft. That was no error for the B-36. I hope you will see it in sufficient time to correct change against the George Howard paper and set the record straight.

E. H. Proctor, Editor
El Paso Herald-Post
El Paso, Tex.

(The U. S. Air Force has given Ayman the following official information in

connection with the B-36 accident. Official investigation, special accident investigation board of Flight Safety Directorate, USAF, on primary cause of crash was an incorrect approach procedure, credited to the pilot and poor judgment of the pilot in attempting a visual approach. The B-36 was cleared from 40,000 ft. GCA gave correct instructions to pilot to clear 40,000 ft. with N-S safety. Pilot elected to ignore GCA and attempt a visual approach. He made this due to GCA operator's radio GCA intended to monitor the B-36 through two missed visual approaches. On the third attempt at visual approach GCA gave pilot emergency instructions to avoid collision. When pilot acknowledged in time to have

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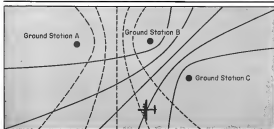
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enclosed a criticism with an known objection to the idea.

There were no travelers in the GCA shack. All GCA men in the shack were pilots of GCA aircraft and had been logging from 25 to 35 GCA missions per month for the preceding three months. At Page AFB, El Paso, Texas was not an GCA of any kind during his speech although he stated that the radio, R-36, could not fly. He stated that in 1933, 1934, 1935, 1936, 1937, 1938, 1939, 1940, 1941, 1942, 1943, 1944, 1945, 1946, 1947, 1948, 1949, 1950, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 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Digital Computers Take to the Air

By Philip Klein

Security wings have been equipped from the Hughes Aircraft Co.-developed Digicac, the first digital computer designed for airborne use and the first version of what has become a significant trend in airborne computer development (AVIATION WEEK Dec. 29, 1952, p. 37).

Digicac is the principal element in a tactical navigation and bombing system which is fully automatic, even in the event of controlling the plane's flight path and automatically releasing bombs at the required instant.

Developed under the sponsorship of the Wright Air Development Center's Avionics Lab, operational details of the new computer were revealed at a recent national convention of the Institute of Radio Engineers. One of the papers, describing the problems of coupling a digital computer to an autopilot, called the HADC program "the first successful use of an airborne digital computer to control an aircraft."

► **Processing Effort**—When the Digicac development was started in October 1945, the state of the art was such that existing digital computers filled a large

size room and their weight was measured in tons. It is doubtful if any plane smaller than a B-50 could have carried a 1945 vintage digital computer into the air.

Even the application of digital computers to analog-computer type bombing and navigation problems involving "real-time" computation was relatively rare.

The HADC WADC development was clearly a pioneering effort.

► **Advantages**—Here are some of the advantages of digital computation which prompted the effort:
• **Versatility**—A single digital computer



THERE GOES THAT PASSENGER . . .

Since he came back from Europe he's been a man to watch. Over there leading airlines are operating the Viscount and setting up new records for passenger preference—and profits! That passenger, based flying by Viscount was something really rare! Certainly it was the most comfortable flight he had ever made. Certainly it was the quietest. Certainly one sensed hardly any vibration—and these four turbo-prop engines sounded a feeling of real confidence. **Watch That Passenger**—Back in the United States he still flies—and talks—and wonders when he will fly by Viscount again. Perhaps sooner than he thinks. For among the new airlines that have ordered Viceroy are two that operate into the United States—Trans-Canada Air Lines and British West Indian Airways.

FORECAST INTO FACT

In December predicted great things for the turbo-prop Viscount. Here is what it has achieved—so far.

- Earned more than \$2,000,000 profit for British European Airways in six months.
- Doubled B.E.A.'s share of traffic on important routes.
- Cut inter-city flight schedules.
- Won four orders from ten airlines in North America—including TCA and B.W.I.A.

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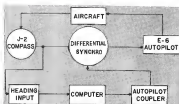
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can work at a variety of problems, in sharing navigation, heading, course control, predicted track of enemy, and others. The older type of analog computer must be tailored to one single, specific task. For missile guidance, a digital computer can quickly and easily be changed to handle new problem procedures (such as new bomb trajectory) which might require very extensive modification in an analog computer.

• **High accuracy.** Extremely high-accuracy accuracy can be obtained in digital computation with little expense in cost or complexity. Computable accuracy may be impossible with analog computers, as do involve extremely precise and costly component parts. At each stage in analog computation, there is some loss of accuracy. In digital computation, there is no degradation of accuracy regardless of the number of operations.

• **Easy to produce, maintain.** Digital computer construction uses many solid-state electronic circuits, such as flip-flops, which can be mass-produced by relatively unskilled labor, by automatic techniques. Mass analog computer parts must be made with extremely precise machine tools, then painstakingly inspected for accuracy and consistency.

Test and operation of digital computer events can be performed quickly and automatically. Lack of complex mechanical assemblies in digital computers permits wide use of quickly re-



BLOCK DIAGRAM shows how Digitec interfaces computed heading changes into E-6 autopilot by differential synchro between gyrocompass and autopilot.

placed play in assembly construction.

Probably the most serious shortcoming of digital computers is their widespread use of electronic tubes, which cause problems of reliability. Analog computers use fewer tubes, mostly for servo amplifiers.

However, more reliable precision-type tubes, and constantly increasing, should cause this problem. Because most digital computer tubes are used as on-off switches, marginal character problems can be used to detect marginal failure due to tube deterioration.

• **Tactical Heading Problem.** Digitec

is designed to work with a ground-based gyroscopic radio navigation system, remembering Lucas. Poles of 84 degree are transmitted of known altitude from three ground stations, A, B, and C. The difference in arrival times (or the arrival) of pulses from Stations A and B, and the time difference between B and C, can be used to calculate the aircraft's position relative to the stations.

Digitec's task is to determine heading position, calculate what it must receive beams (based on plane's speed, altitude, etc.) to hit a target of known position, determine what heading the bomber must fly to reach the heading point, control the plane through its autopilot to bring it to the point of bomb release and, finally, trigger the bomb release.

Digitec can be programmed to guide the plane to a series of targets and bomb release points, possibly as many as 10 or 15.

• **Establishing Accurate Position.** Digitec determines heading position in space from a combination of radio navigation and dead reckoning, or solely from dead reckoning when the radio signals are not usable. The combination is used to smooth out minor variations or noise in the radio signals.

The dead reckoning computation is made from continuous and automatic aspects of airplane heading, speed, previously computed heading position, and wind velocity and direction (previously calculated from radio navigation information).

Interesting features, arising from a digital computer's ability to "make decisions," is that Digitec automatically determines when radio signals have become unusable and then switches over to dead reckoning to determine heading. When radio signals improve sufficiently, Digitec automatically reverts back to the combination mode of determining

what is the position of the bomber.

• **Most Degrading.** Digitec occupies six square feet half second. During that time it makes more than 50 "decisions," E. E. Bolles told the IRE. Bolles was formerly with Hughes, a now with Raytheon-Westinghouse.

"Each input, such as altitude, is fed directly to the decision of it is within a maximum and minimum bound and then a check is compared with the past value. If the quantity differs enough the bounds or the change from the past value is too great, then this quantity is discarded and the previous value is used," Bolles said. This technique greatly reduces the effects of any "round" present in the input data, Bolles added.

The computation cycle for the dead reckoning portion of Digitec requires only 0.1 second, 0.2 second between the cycle needed to be performed by radio signals. In its "open time," the dead reckoning system can be used to perform bomb trajectory and compensation computations, without requiring additional machine capacity for this specific task.

• **Digitec Digitec Tests.** Nearly 60 flight tests were made on Digitec over a 14-month period starting in late 1957. Dr. E. M. Grubbs told the IRE. The test plane was a C-47 equipped with a Minneapolis Honeywell E-6 autopilot. Dr. W. Barbeck and S. B. Meier of WADC were coauthors of the paper. Interestingly, said that Grubbs, Barbeck, as well as Bolles, have recently left Hughes to join the Raytheon-Westinghouse Co., newly formed company headed by two former HAC vice presidents.

Flying over well-defined areas in metropolitan Los Angeles, a virtually tribulation course was used to check the accuracy of the basic radio navigation system. Dr. Grubbs said. The latter was then used to check the accuracy of Digitec's performance, including its dead reckoning computation. Many of the design changes which were tried during the Digitec flight tests in the prime system operation could be made quickly without halting air tests. Dr. Grubbs and pointing up another advantage of the inherent versatility of digital computers.

Details on Digitec's accuracy are still classified. However, Bolles told the IRE that the novel digital computing technique which Digitec uses to compare automatically the time difference between pairs of radio pulses provides an accuracy of 0.02 microsecond at about one mile in 10,000.

• **Digitec Details.** The complete Digitec system, including digital computer, receiving and time-converting circuit, power supply and autopilot coupler, occupies a volume of 12 cu. ft., weighs around 350 lb. The digital computer

Valve Tak

by Wm. R. WHITTAKER Co., Ltd.
by Marvin Miles
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The big yellow sheets of ruled paper looked formidable with their handwork of neatly written figures, but they told a straight story—the story of Valve Tak's success during 1955.

They had to be deciphered for me at first, of course, but once I learned the key I could read the story myself.

And the claims interested me most.

I found dead action was taken on 372 basic valve proposals made by Whittaker last year and on 336, 36 per cent were sold, 53 per cent cancelled and but 11 per cent lost to competitors.

I would say that was an excellent record for a year's business.

But the Whittakers expect much better results.

"Good," but not good enough. We can do better."

They explained to me that their tremendously detailed analysis of study each year—a complete breakdown of business according to customer, service, valve type and the dollar not lost for each—primarily to show up weaknesses to improve strength in other words to present by and figure the loss in which for company sales improves its own in 1956.

Moving it out, let's all share on the ground and each category summed up in two sets of figures, "year previous" and "year current."

Why, I asked, "the high per cent of cancellations?"

"It's not the nature of the business," the experts told me. "We know exactly if the system has been made with no engineering men designed loss, face each case and money is spent in production and must be the exact value that we require."

"You see," they went on, "this is a fact, not, the valve and the system are not made with reasonable assurance that they'll be made next year. We have to meet new demands as they come."

"We'll be asked to bid on a valve. We'll look up the possibilities and we'll make design changes or we'll further let you might call Whittaker's assistance. We won't bid on something we can't make with no design proposals and as we don't overtake sales we can't carry them that far."

"On the other hand, a request may look good and we put in a great deal of effort only to find the valve cannot be made and because of unforeseen changes. Or because the industry has turned down a proposal we may not carry them that far."

"It's no use! That's just one of the factors you have to contend with in this market business."

"And that means that Whittaker proved out to a range of better than 20 new designs each month?"

"Correct."

"How many top jobs did you get?"

"We sell."

"I'll bet they do, too!"

But the Whittakers expect much better results.

"Good," but not good enough. We can do better."

"That's a challenge," they replied. "Our analysis is designed to show us just where we are weak. Then we must to change our product and ourselves. No one asking our best to be sold. Unless we select work plans to sell the new and we're not likely to sell in the head of the parade, we even keep up with it."

"Several years ago we found our hydraulic business down. The reason? Because the valve and the system were not made with reasonable assurance that they'll be made next year. We have to meet new demands as they come."

"On the other hand, a request may look good and we put in a great deal of effort only to find the valve cannot be made and because of unforeseen changes. Or because the industry has turned down a proposal we may not carry them that far."

"It's no use! That's just one of the factors you have to contend with in this market business."

"And that means that Whittaker proved out to a range of better than 20 new designs each month?"

"Correct."

"How many top jobs did you get?"

"We sell."

"I'll bet they do, too!"



Advanced Airborne Computer

First photo of new advanced airborne digital computer, developed by Digitec Aircraft for use with a new category for combat systems, shows some compact construction than other Digitec. Information related on the new computer includes:

- Clock pulse rate: 100 kc.
- Volume: 4.5 cu. ft.
- Accuracy: 1 part in 10,000

- Magnetic drum storage: 1,500 15, 400 words
- Fast memory storage: right with in one millisecond
- Address system: modified two-address, floating reference
- Operations: 14, including addition, subtraction, multiplication, division, square root, check sum, logical shifts, logical multiplication, shifting, transfer
- Inputs: 64 analog inputs

shelf occupies 54 cu. ft., weighs 130 lb. Bellini and others freely admit that Digitec is made obsolete by more recent digital computer developments at Hughes and elsewhere. Pointing out that no attempt was made to achieve optimum miniaturization in Digitec because of its experimental nature, Bellini informs that the computer volume could be reduced to 15-2 cu. ft. by using transistors in place of tubes.

The complete system uses 414 tubes for computer portion, some 265 tubes and 1,930 diodes. Total power consumption is 1,340 watts, including power for the required cooling system.

■ **What Makes Digitec Tick?**—In digital computer language, Digitec is a dual-address, binary-coded machine operating in serial manner.

A serial-type machine transmits data to reduce complexity. However, Digitec speeds system time by using a dual-address system of a single-address type of operating instructions for the computer module.

- **Execution (throughput) time:** 0.5 second for reception and loading problems.
- **Clock pulse rate:** 100 cps.
- **Word length:** 17 bits, including sign.
- **Memory storage:** Rotating (7,300 spin) magnetic drum, with storage capacity for 1,024 words (two-address commands, problem constants, computer results) plus a word fast-access circulating register for intermediate results.
- **Address system:** Fluctuating reference instructions for finding next operations contained in the magnetic drum is referred to the position where the problem operation was recorded.
- **Number of possible operations:** 17,

including 14 which cause computer to sample unattended input signals in which order output of computer signals for navigation and landing control. Remaining 13 operations are manual mathematical operations of addition, subtraction, multiplication, division, and associated transfer operations. One dual-address operation is provided to select one of two alternate addresses, such as alternate operating modes or to check the quality of input signals, as earlier described.

■ **Autopilot Capable:**—Where a digital computer is used to control an airplane's flight path via an autopilot, problems arise because of the inherent computation-cycle delay (0.5 sec.).

When a digital computer with continuously varying inputs produces a continuously varying output signal, Digitec produces a new output signal only once every half second.

Analogue problem arises because a digital computer may malfunction in a single computation cycle and cause up to a half-second error.

■ **Interference:** Digitec Signals—The Hughes autopilot computer introduces Digitec output (interfering command) signals into the basic autopilot loop in manner of a differential switch between the 1:1 gyrocompass and the B-6 autopilot, which enables the gyrocompass heading signal seen by the autopilot. Hughes selected this approach. W. L.

Allen told the IRE, in preference to feeding autopilot signals into Digitec, because of aircraft stability considerations. (A. D. Sturgeson to interview the paper).

If the high frequency transient sig-

nals developed in an autopilot were fed through Digitec, operation transients generated within the digital computer would also pass through into the autopilot control system. From pointed out.

It is possible to filter out these computer-generated transients and use smoothing techniques which are only possible if the digital computer itself remains outside the basic airplane autopilot loop.

■ **Digital to Analog Conversion:**—The digital output of Digitec is converted to analog notation of the differential synchro by means of a shifting-counting type electronic register which operates a stepping motor that drives the synchro. After each computation cycle, Digitec generates its output (interfering signal) in the register which is then "counted down" (reset) once by a pulse generator.

Each pulse applied to the register driving count-down causes the stepping motor to rotate the differential synchro an amount corresponding to a heading change of 1 degree, in a direction determined by the "sign" of the signal in the register. When the register has been counted down to zero, the differential synchro has introduced a course change into the autopilot corresponding to the Digitec steering signal.

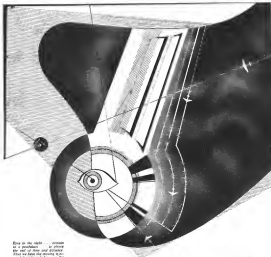
When large steering signals accumulate in the counting register for more than brief intervals, the count-down rate is increased automatically by a factor of up to 4:1. This technique has been demonstrated to be highly satisfactory for countrolling the accuracy when the required heading change is within the ± 12.6 deg. capacity of the shifting-counting register, according to Foster and Sturgeson.

For extremely large heading change signals, up to 180 deg., the register causes the differential synchro to rotate in a still faster rate, putting the plane into a steep banking turn whose angle is limited only by autopilot response limitations.

■ **Flight Future:**—Messrs. Gouba, Barbeck and Neuber sum up the future of advanced digital computers this way:

"The day is not too far off when an advanced airborne digital computer will be used in a variety of different military and commercial (aircraft) systems for automatic navigation and control. . . (and) can also act as a central computing point for a variety of auxiliary computations."

Hughes Aircraft is continuing work in this field. Its new advanced general purpose solution digital computer, probably slated for use in an advanced autopilot low cost control system, was displayed for the first time at the Hughes booth during the recent IRE convention. First public discussion of a new trans-



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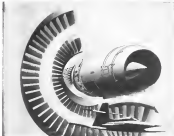
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Radar for Refueler

Albion AN/APR-42A radar, shown being installed in this Boeing KC-97C Stratoflighter, operates with radar antenna gear to help large tanker refuelers with other

aircraft during aerial refueling operations. The radar is also used for terrain avoidance, navigation and terrain clearance. RCA and Boeing-Pacific are making the C-97 units.



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authorized airborne digital computer, the Tronic, developed by Bell Telephone Labs, is scheduled for the National Conference on Airborne Electronics in Dayton, this week.

Only their most enthusiastic proponents would suggest that digital computers will ever replace analog computers in all airborne applications. However, the fact that more than a dozen companies are now developing airborne digital computers is testimony of their potentialities.



■ **Nav Tek-Wilson Electric** recently set up its new packaged low-power electronic station at Dover Airport, Maryland, and put it into operation within two days after the equipment arrived on the site, despite its intervening blizzard. Object was to demonstrate the new VOR to members of the Fifth Communications Section of the International Civil Aviation Organization meeting in Montreal.

■ **U.S. Radio Report** issued-United Air Lines has issued a 185-page report on the results of last summer's flight tests on an experimental C-54 (S-5) airborne radio. Report's conclusions, highlighted, appear in *Airline News* (Sept. 28, 1955, p. 84, Dec. 23, 1955, p. 7) strongly favor C-54 over X-54 (S-5) for airline use.

■ **Nav and Tech-New Spray and General Electric** companies paragon (see sidebar) are handling for USAP four air evaluation tests now underway at Air Force Armament Center, Eglin AFB. At the moment, observers report it is a long shot as to which will get the production nod.

New Avionic Belongings

Recently announced technical bulletins and catalogs of interest to designers of avionic devices and equipment include:

- **Micro-wave communications and multiplex equipment**, 22 pp. Collins Radio Co., Cedar Rapids 1945.
- **Electronic wave control systems**, MIL-STD-883B, 1-1, 1-2, 1-3, 1-4, 1-5, 1-6, 1-7, 1-8, 1-9, 1-10, 1-11, 1-12, 1-13, 1-14, 1-15, 1-16, 1-17, 1-18, 1-19, 1-20, 1-21, 1-22, 1-23, 1-24, 1-25, 1-26, 1-27, 1-28, 1-29, 1-30, 1-31, 1-32, 1-33, 1-34, 1-35, 1-36, 1-37, 1-38, 1-39, 1-40, 1-41, 1-42, 1-43, 1-44, 1-45, 1-46, 1-47, 1-48, 1-49, 1-50, 1-51, 1-52, 1-53, 1-54, 1-55, 1-56, 1-57, 1-58, 1-59, 1-60, 1-61, 1-62, 1-63, 1-64, 1-65, 1-66, 1-67, 1-68, 1-69, 1-70, 1-71, 1-72, 1-73, 1-74, 1-75, 1-76, 1-77, 1-78, 1-79, 1-80, 1-81, 1-82, 1-83, 1-84, 1-85, 1-86, 1-87, 1-88, 1-89, 1-90, 1-91, 1-92, 1-93, 1-94, 1-95, 1-96, 1-97, 1-98, 1-99, 1-100, 1-101, 1-102, 1-103, 1-104, 1-105, 1-106, 1-107, 1-108, 1-109, 1-110, 1-111, 1-112, 1-113, 1-114, 1-115, 1-116, 1-117, 1-118, 1-119, 1-120, 1-121, 1-122, 1-123, 1-124, 1-125, 1-126, 1-127, 1-128, 1-129, 1-130, 1-131, 1-132, 1-133, 1-134, 1-135, 1-136, 1-137, 1-138, 1-139, 1-140, 1-141, 1-142, 1-143, 1-144, 1-145, 1-146, 1-147, 1-148, 1-149, 1-150, 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EQUIPMENT

BuAer Tests Silver-Zinc Aircraft Battery

• More capacity at less weight is claimed for new low-exchange power units that Navy is testing.

By George L. Christian

A new type of storage battery which is several times smaller and lighter than lead-acid batteries of equivalent capacity is being tested for several applications by the Navy's Bureau of Aeronautics. Weight field will soon start evaluating the unit.

A major advantage of the unit, called the Yardley Silverzinc, is that its high capacity and ability to withstand high discharge rates make it capable of starting jet engines several times before becoming completely discharged.

Many State-Design is a recent test on a Grumman F-106, a Yardley Electric Corp. Silverzinc battery of the standard AN1150 aircraft was installed in the plane's engine 10 times in 90 minutes period. Test had to be discontinued because the engine's starter got too hot, Yardley says.

The Silverzinc was checked and found to have retained half of its original capacity. Yardley officials, however, there was sufficient charge left to have started engine another eight times.

Implications is that jets are no longer be dependent on auxiliary power during engine start, and that jets are no longer be dependent on auxiliary power during engine start, and that jets are no longer be dependent on auxiliary power during engine start.

The cells have been used in various applications for more than a half year, primarily in studies where their light weight, small size and high capacity are of major importance, Yardley says.

Silverzinc, Zinc and Lead—Two principles on which the Silverzinc is based. Help get the battery, also many advantages claimed for it. They are the aluminum aluminum plate construction and the low exchange principle.

Silverzinc, The silverzinc, makeup of the battery's plates results in the smallest and light weight of the unit. Also, the extremely low loss of the electrodes makes the battery cells particularly resistant to shock and high G loads. The electrolyte is potassium hydroxide.

Low exchange, Martin, Kansas, Yardley vice president, told American Wire



BATTERY under nose of Grumman jet can do job of auxiliary power unit in pitch.



AIRBORNE INSTALLATION shows Yardley Silverzinc under standard AN1150 battery in equipping Grumman fighter. Silverzinc is smaller, has three times the capacity.

that the low exchange principle, which he said was originated by him, compares and is fully covered by patents, being added advantages to the Silverzinc. Since early use, not chemicals, are exchanged between plates, "moving" of plate material and resulting possibility of internal shorts are eliminated, prolonging the cell's life to two to three times that of a lead-acid battery.

Yardley took a walkout of the first low exchange cells—low exchange systems were not conducive to high rates of discharge. Recently, company technicians developed specially designed

plates which have better high-charge and discharge rate characteristics. The first production two different types of cells. The LR series has long cycle life and average high discharge rates, while the HR series has a very high discharge rate but a lower cycle life. Silverzinc made three cycle life comparison with a lead-acid battery. LR series Silverzinc, 80 complete cycles; HR series Silverzinc, 10 complete cycles; lead-acid battery about 30 cycles.

The new cells with the specially designed plates are called HRV cells and combine some of the advantages of both

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the LA and HA units. The HA unit cell is now in production and is going into aircraft batteries.

High Discharge Rate—Kagan quoted the comparative high discharge rate figures for standard AN3151 and AN3150 lead acid aircraft batteries and three Silvercel equivalents.

AN3151 (Lead acid), about 150 amp/hr
SD3151 (Silvercel), approx.
lead up to 400 amp/hr

AN3150 (Lead acid), about 500 amp/hr
SD3150 (Silvercel), approx.
lead up to 1,000 amp/hr

Very low internal resistance permits these high discharge rates. Minimum permissible current draw is limited only by the heat generated within the cell. Yandey adds that the non-porous efficiency of the Silvercel is affected very little at high discharge rates.

Light & Small—Weight and size also compares favorably with the Silvercel and conventional lead-acid batteries. The following Yandey battery is model HR10L, with 200 amp-hour nominal capacity.

	Silvercel	Lead-acid	Model
Approx. Wt.	32	8	7.4
Wt./hr. amp.	39	1.6	1.6
Approx. size, in.	2 1/2	4 1/2	5 1/2
Wt./hr. amp., lb.	8.4	1.6	2.5

As a result of these comparisons plus those of alloy steel case batteries, Yandey makes the claim that its Silvercel units are roughly six times lighter and five times smaller than equivalent lead-acid batteries.

Maintenance Charge—The Silvercel has an extremely long shelf life. In the dry state, the battery is said to have an indefinite shelf life.

A dry battery may be filled, charged, completely discharged and may be used for a year under field conditions. This is called the "ready state." Batteries have lasted two years under laboratory conditions.

A discharged battery in the ready condition may be fully charged in one hour Yandey claims that the one hour charging time is not recommended as a steady diet, but may be done occasionally without damage to the unit.

Standard maximum time is two hours. When a cell is in the dry condition is filled, a small period of two or more days is usually allowed.

The Voltage Curve—The Yandey battery has no over- or under-charge. Kagan points out that the curve remains flat until the battery is almost completely discharged. The curve remains flat in the dry state, but voltage can be raised at the end of the curve if necessary.

Thus the cell will deliver full voltage until power is almost completely cut.

Reliability Maintenance—Big consideration from both the military and com-

mmercial point of view is the almost complete lack of maintenance required by the Silvercel battery. Under high-temperature operating conditions, electrolyte is sealed into the unit a year.

Under two different test conditions, only 4% electrolyte was added to 500 recent batteries after operating under standard temperature conditions for nine months.

It was unnecessary to add even the small quantity of electrolyte, Ford Hare and, technical director explains, but it was done to maintain the amount of electrolyte required to bring the level up to the full mark.

Yandey declares that for most models of Silvercel it should not be necessary to add electrolyte during the entire life span. After leaving Silvercel usually with potassium hydroxide, further solutions need only be distilled water.

Only one regard of the battery is to keep it reasonably clean.

Spillage—If the Silvercel is spilled, almost all the electrolyte is absorbed by the non-exchange material in the cell's separator. Liquid level is highest in the charged condition and lowest in the discharged condition.

The battery is not necessarily leak-proof, Yandey cautions. Leakage, however, has been occasional and only as much as it attends not sealed by other types of assembly.

The chemical reactions occurring during operation of the battery are not easily reversible. They may be reversed this way:



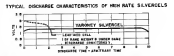
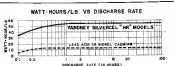
► Mechanically Strong—Relatively low weight of the materials inside the cell are used to make the unit quite resistant to mechanical stresses such as shock, vibration and acceleration. This resistance is aided by the fact that the interior of the cell acts as a solid, compact mass, which, when sealed down, seals thereby protecting the most sensitive parts.

In a special case, a Silvercel operated normally under conditions of 1,000G built up in a matter of milliseconds, Kagan reported.

He quoted these results of a specific test, performed by a government agency, on a 1 amp Silvercel:

"After acceleration tests ran up to a combined, followed by 500G at 5 psi overboard shock. Cell was subjected to 2,000 cycle vibration with constant peak of 100G. Tests were performed in three planes. Performance of the cells was efficient throughout the test."

Other tests cited by Yandey show that damage discharge under 10G vibration and 100G shock in various planes, voltage variation was less than 4% with no loss in capacity.



► Alkaline & Temperature—Yandey batteries perform well at extreme climates, the company says. With proper packing, they have operated at high as 150°F.

The cells have good temperature resistance. At the high mark, cells can operate satisfactorily at 165°F for extended periods of time. High temperature limits depend on type of container (usually steel or plastic) and boiling point of the electrolyte.

At the low end of the scale, the electrolyte will freeze between -50°F to -75°F. The higher the charge, the greater its resistance to cold.

Under severe cold conditions—say -50°F—the cells can be warmed up to proper operating temperature in 10 to 15 min. by shorting out the two poles. The correct solution had to make the battery operative but in no way injures the unit, Yandey says.

Aeronautical Applications—The Silvercel has won aeronautical service for the past 24 years. Primary duty has been in missiles. Boeing Airplane Co. alone has taken delivery of over 8,500 units. Yandey says that not one of these units was rejected after Boeing inspection.

Cells are also going into missiles manufactured by Hughes Aircraft, Republic and Bell Aircraft. Silvercel are going into a graduation test made by Bell Aircraft. Solar is using the battery to supply current to the starter of a helicopter installation of the battery.

Missile Evaluation—Yandey officials point out that if the Silvercel becomes standard component on jet aircraft, it will mean that designers may return to putting electric starters back into the classic form which they have been accused of having to introduce other power means such as catalytic starting.

They say, "Since you must have an electrical system in any plane, why not put it to its most use as possible instead of having multiple systems on the aircraft."

The batteries not only could start themselves, experts feel, would allow planes which have made emergency landings at small fields not equipped with auxiliary power units, to get started under their own power.

Stretching the availability of electrical power up to three times over that pro-

deadly trigger finger...

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It is a complex system but hardly a challenge to the Crosley background in radar and fire control, other weapons, shipboard, ground mobile or fixed radar, and more.

Crosley defense production not only spans the whole field of electronics but has an equally wide spread in the mechanical and electro-mechanical fields from components to complete systems.

Crosley has lived up to schedules on government development and production contracts—proof that Crosley does the job RIGHT and delivers ON TIME. Proof too that the close Crosley cooperation of research, development and manufacturing skills pays off fast in production of major units and systems to meet rapid military requirements.

• "Right and On Time" an illustrated booklet describing Crosley facilities for military production, is available to Procurement Agencies and other defense contractors. Be sure to order for your copy today.

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visibly mobile for such controls in tight quarters and in flight conditions. You will meet the difference between saving or losing a pilot and plane. Yardley says.

The SilverCell provides designers with two alternatives.

Either they can stay with batteries of the same size as used today and, by using SilverCells, obtain approximately three times the capacity and five to five times the maximum current drain capabilities.

Or they can reduce size and weight three to four times, retain about the same capacity and still have greater current draining capabilities.

• While Other Think—There are some comments on the SilverCell from well known manufacturers of aircraft and equipment.

• The battery can be used in any orientation where high electrical current storage battery is needed. It can be used at -60° without external heating unit.

• Shooting out the battery brought it up to operating condition in 12 min. The battery weighed 25 lb. compared to 135 lb. for an AN-950 battery plus its associated heating equipment.

• The battery was tested down -75° to a cell case temperature of 234°.

At the high temperature the plastic case warped but battery operation was unaffected.

• The battery is a jet aircraft "fail over" failed to give satisfactory data.

• Silver Reusable—The greatest cost of the SilverCell is approximately four times that of a comparable lead-acid battery. But, because the silver used in the cells is completely recoverable, this cost could be reduced considerably under most production conditions. Yardley officials believe.

As to the future, one of their goals is a battery with at least a twenty-charged shelf life. With the recently developed, improved air exchange apparatus, they are confident that this goal is well within reach.

• Status Today—With a \$3-million Navy ReCell contract under its belt, Yardley is stepping up production of its SilverCells. Backed a majority by largest customers. The battery is used to have many advantages for underwater applications.

Production for aeromedical applications is "over 20%," Yardley says. But this will increase during the current year. So will its number of employees, now 500.

Yardley has just purchased a five-story building in lower Manhattan and will soon consolidate its activities under one roof. Its executive office, manufacturing plant and laboratory facilities are now scattered in three different buildings in New York.



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That's what the Tech Sergeant wrote after inspecting this Servomechanisms, Inc. electronic controller that came out of a wrecked fighter in Korea. The spec didn't call for operation after this kind of treatment—but we're not surprised. We build reliability and ruggedness into all our equipment.



Designed and Produced at El Segundo, California and Westbury, New York

WHAT'S NEW

New Literature

Selection of steel cutting material is simplified with Lehnman Coated Slide Chart. Included is information chart given the material analysis, chemical mechanical properties and heat treatment of various steel grades. Write Lehnman Steel Foundry, 51 Lehnman St., Lehnman, Pa. . . 66 page Symposium on Pitting Corrosion is available at \$2 a copy from American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. . . Adaptability, application and complete specifications of rubberized aluminum are covered in Catalog No. 57 by Crown Manufacturing Co., 51 Nelson St., San Francisco, Calif.

How-to-test handbook contains 36 pages of hints for precision cylindrical gauges used. Available from Leeds Viol Co., Weymouth, Pa. . . Pyrometer Thermocouple Calibration Data-Booklet. P1295 contains tables based on data recently released by National Bureau of Standards and adopted by Scientific Apparatus Makers Association. Instrument Society of America. Write to Bureau Co., Waterbury, Conn. . . Illustrated manual contains 34 pages of information on vapor degreasing. It is put out by Ceres Equipment Co., 170 Central Ave., Clark (Newark), N. J.

Data sheets describing company's facilities for producing **solid state** for aircraft industry may be obtained from Franklin Electronic Corp., Woodbury, Indiana, Ind. . . Motor Builders from Leo Spies to Motor Systems Co.'s contributions to the science of using plant gas most efficiently. Write the company at Weymouth, Mass. . . Coated systems for laminates, woods, dyes and films are covered in 46-page Bulletin F1160 put out by Resol Co., Waterbury, Conn.

Publications Received

- Helicopter Rating—first edition by Charles A. Zeng—put by The American Helicopter Service, 1201 Western Blvd., North Hollywood, Calif. \$15 pp. plus sht. With \$5.00. Guide to CAA helicopter pilot program, with typical examination questions and answers.
- The Aeroplanes Directory of British Aeronautics, Incorporated: What's Who in British Aviation, 1954 edition—Compiled by the Staff of The Aeroplane Club by Temple Press Limited, Basingstoke, Great Britain, London, E23 3HS pp., 21 illustrations, approx. \$1.00. Guide to aviation in the British Commonwealth, together with a biographical index containing over 1,600 entries.

BEFORE THIS JET CAN FLY



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COX Multiple Stage Type 12
FLOWMETERS

Ever stop to wonder why Cox Multiple Stage Type 12 Flowmeters are so widely used by the U. S. Airforce and U. S. Navy?

The answer is that both these services must know exactly how much fuel a plane's fuel pumps and fuel nozzles can handle in a given amount of time—in order to determine the operating reliability of its intricate fuel system. In jets, particularly, accurate flow rate testing is essential, since the fuel system must be capable of pumping and carrying tremendous amounts of fuel each minute the plane is in the air.

Experience has shown America's major users of precision flowmeters that the Cox Type 12 can always be depended upon for first rate performance. Its record of service is unmatched in providing accurate, dependable testing of jet nozzles, fuel pumps, carburetors, and other items forming the vital "flow system" of jet and rocket engines.



The Cox Multiple Stage Type 12 is available in three series—the 40, the 90, and the 100. All possess remarkable accuracy, repeatability and quick response. Maximum capacity of the 40 Series and the 90 Series is 26,000 pounds per hour. The 100 Series provides a maximum flow capacity of 25,000 pounds per hour. Use of its bypass orifice greatly increases the flow capacity of each instrument without increasing its frontal area.

Readings to the nearest graduation on individually graduated logarithmic type scales are normally within 1% to 1% of the indicated flow, depending on the particular series. Flowmeters are calibrated for a specific fluid and scales for measuring liquids of different characteristics can be easily interchanged.

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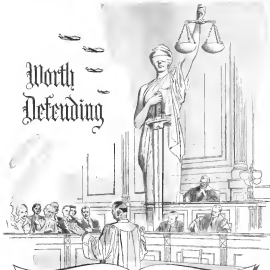
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NEW AVIATION PRODUCTS



SEMI-CIRCULAR unit speeds assembly

Bin System Simplifies Small-Parts Handling

Small parts storage and handling are simplified with a new bin system developed by Service Parts Systems, Inc. Removable containers are loaded onto storage racks which come in various sizes and shapes, both fixed and portable. When the containers are empty they may be stored and replaced with full ones. Or when short production runs require frequent changes of assemblies it is simple to substitute containers with new parts for the old ones.



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The containers have rounded bottoms to make it easier to pick out parts. They are fitted in the racks for easy visibility of the contents. Individual racks hold as many as 200 containers. By placing a number of units end to end in a row, a large number of different parts may be stored in little space, the easier way.

Service Parts Systems, Inc., P.O. Box 143, E. Detroit, Mich.

Midjet Punch Press Is Precision-Built

Precision built, midjet punch gives a bang put on the market by Keros Manufacturing Co.

The 14-ton unit follows general lines and specifications of the company's 4- and 5-ton presses. It features a solid construction of alloy steel, roller bearings, hydraulic, clamping system, self-contained and independent of outside, alloy steel drive roller.

Leach CONTROL RELAYS

FOR UNEXCELLED PERFORMANCE

Furnishing Relays that excel in performance is a Leach specialty. Their rugged strength and smooth endurance provide uniform control, protection and dependability.

No matter what your Relay application, we invite you to share our nearly four decades of experience and facilities as designers, engineers and manufacturers of a complete line of relays.



CHARACTERISTICS

Leach Part No. 1022 (Mechanically Sealed) Approx. Terminals

CONTACTS
Arrangement—4 Pole Double Throw Switch—12 mm coil size and induction at 20 v d.c. 10 amp. motor load at 25 v d.c. 10 amp. resistive at 115 v a.c. 400 cps. CTR—100 mm, 10 x 4 x 10 mm.

WEIGHT—70 lb.
Also available with Solenoid Actuators—Leach Part No. 10222

DIMENSIONS



DIMENSIONS



Leach Part No. 10222 Sealed AM Control Mounting Same Characteristics as above

APPROXIMATE
WEIGHT—20 lb.

Mechanically Sealed and Sealed—Midjet—Control—Approx. Relay & Contact—Special Purpose—Relay & High Frequency—Relay

For your specific requirements and for RELAY CONTROL THROUGH RELAY RELAY—Contact Leach



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alloyed bronze connecting rod and conical bearings and 90-deg V-type arm and rim gages. The frame is of special alloyed casting structure, precision machined for accuracy.

Standard stroke is 1 in., with 1 in. optional at extra charge. Frame is open back and adjustable.
Kuehn Manufacturing Co., 5211
Telegraph Rd., Los Angeles 22.

Flat-Angle Drill for Close-Quarter Work

Any Equipment Corp. has developed an air-powered flat angle drill that follows a small lead for working in close quarters, plus heavy-duty ball joints to increase the tool's life.

The company says it was able to decrease size where needed at the drilling end by relocating the level gear to the rear end of the bearing, a change that permitted use of more rugged gears than in former designs.

In the angle head, precision gears are mounted on acetal bearings.

Act reports are made in the drill also increase tool's strength and life.

• Double end view is used in the right angle assembly.

• Lead-forward steel alloy with graphite-type features is used on the cover plate of the drill's iron casting assembly.

Head height of the new drill is 11 in., a reduction of 2 in. in the standard size. Spindle offset is 6 in., and overall length for Model 7435 totals 10 1/2 in.

Tool components are interchangeable for speed conversion, with models available for 1,450, 1,100, 1,780 and 4,000 rpm.

Any Equipment Corp., Bryan, Ohio

ALSO ON THE MARKET

Deadlocks, one-piece, weather-and-rubber "O" ring construction, reportedly provide leak-proof sealing against fluids, gases or air, around bolts where they go through walls, bulkheads or ducts, retaining such fluids or gases. Units are available in 5/8 in. to 1 1/2 in. nominal bolt diameter—Rubber Tech, Inc., 18115 S. Hercules St., Gardena, Calif.

Glass-headed lead wire for electronic and electrical components operating at temperatures from -55C to 200C in computer primary conductor suitable for use of Teflon for high dielectric strength, low power factor, high moisture resistance and a low dielectric constant. Secondary insulation of Teflon impregnated glass head reportedly of leads surround assistance to vibration. Product is known as Triplexed-Hi Temp Wire, Inc., 35 Windsor Ave., Milwaukee, Wis. 1

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Pumps last longer with Skydrol. Maintenance records show up to 34% longer actual service life... with component overhaul costs reduced as much as 20%.

Liability. Noncorrosive Skydrol does not harm metal parts... its lubricity factor remains constant even after extended use.

Low Cost Conversion. You'll be surprised... it costs very little to convert your aircraft to Skydrol. Write us for information.



Write for Skydrol booklet—Organic Chemical Division, MONSANTO CHEMICAL CO., Box 438, St. Louis, Missouri. Product No. 12-12-107



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values and the willingness of the aircraft industry to operate with the most advanced type of equipment available (despite rapid obsolescence much greater than provided by depreciation reserves accumulated in past periods).

For this reason, measuring profitability on static net book valuations may not always prove very reliable.

■ **Return on Book Value**—It is interesting to observe that, based on book net asset valuations as compiled by the National City Bank, the aircraft group showed a net return of 21.7% in 1955 as against 17.9% in 1952 and only 7.9% in 1949.

The aircraft group's return on book net assets was the highest for any of the separate industrial categories shown in 1955. All manufacturing companies averaged a 12.5% return on their book valuations last year. It is also noteworthy that while all industries increased its book net assets by 6.0% last year, the aircraft industry added to its facilities on the same basis by 12.3%.

■ **Excess Profits—During 1955**, excess profits taxes took a heavy toll of aircraft earnings. The effective tax rate for most aircraft companies was close to 50% (Neither Martin nor North paid EPT, however, due to previous tax credits, and North because of a deficit due to special contracts.)

For those companies not on a calendar-year basis, these remnants of the EPT will be felt more in 1956. For example, a company with fiscal year ended Sept. 30 will be subject to the added impact for a three-month period. But it will be averaged out over its entire year.

There is no doubt that the removal of excess profits taxes should be beneficial to aircraft earnings. Certainly, net profit margins on sales for 1954 should be no lower than the average 24.5% shown for 1953 and 1952. If anything, prospects would favor some improvement in this profit margin.

Ultimate results will, of course, be influenced by the course of contract price negotiations and subsequent renegotiations. But renegotiations will come two or more years after sales and earnings are recorded for 1956. So adjustments, if found necessary, may have the nature of a delayed reaction.

Despite this qualification of 1954 optimism, the aircraft group should again enjoy a profitable year. Volume deliveries should remain high. For the group as a whole, net earnings may at least equal 1953 results, with conditions favoring a new high.

Not all companies will participate uniformly in this profitability, however. Selectivity is always, very pronounced during 1955, will become even more so in 1956.

—Sally Altschul

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To keep our air and ground defenders' standing sharp is the job of the Firebee, America's new high-performance pilotless jet plane. A product of Ryan Aeronautical Company's advanced aeronautical engineering, the Firebee was developed as a joint project of the U. S. Air Force, Army and Navy. It is now being manufactured for use by all three services.



The Firebee carries no human pilot, yet this remote-controlled target plane has phenomenal performance like a modern fighter. It is launched either from the ground or from a "mother" plane and is recoverable by a highly efficient parachute system that lowers it gently to the ground.

Design and development of the Firebee demanded the highest level of scientific talent and technical ability—in the aerodynamic, structural, mechanical, metallurgical and electronics fields. In this latest proud accomplishment, Ryan drew on rich experience gained through its 31 years in the forefront of aeronautical progress.

Because Ryan is specialized, ingenious and versatile... because it is an integrated company with superior abilities in many specialized fields, Ryan is better prepared to accomplish the unique, difficult technical engineering and production assignments of today's high-speed air age.

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Metallic and Composite Parts
Thin Wall Structures
Fuselage Profiles Jet Planes

Pioneers in Tech • Leaders in All



TAKING TIME OFF from the job of coping with busy schedules, Boeing Stratocruiser undergoes maintenance at PAA's Miami base.

PAA Rides Aircoach Boom to New Peaks

- U. S.-flag line carries record number of passengers to and from America, widening lead over competitors.
- Tourist-class traffic accounts for nearly half of total sales, is expected to increase by 50% this year.

By Frank Shea, Jr.

International aircoach travel is blossoming, and Pan American World Airways—richly proven and staunchly supported by low-fare international competitors—is making the most of it.

Last year, widening its lead over all competition in transportation of passengers abroad, PAA carried 28% of all overseas traffic to and from the continental U. S. by a record total of 1,677,908 passengers. Aircoach traffic accounted for 41% of passenger revenues.

This year, the company expects an even greater increase in passenger traffic, with current plans for a single sale. Willie G. Lapinich, vice president for traffic and sales, forecasts a 18% increase in overall traffic with a 25% jump in tourist sales.

• **Boeing the Boeing-New York** are produced for almost all categories. "This would mean having four record figures of last year."

• **Net income** hit \$10.5 million, a jump of more than 54 million over 1952.

• **Gross revenues** climbed to \$217.6 million, excluding the operations of Pan Am's and affiliated airlines.

• **Operating revenues** increased by 6.2%, while operating expenses went up only 3.5%.

• **Costs per available ton-mile** dropped from 45.2 cents to 42.4 cents.

• **Dividends** paid out totaled \$30 million or 67 cents per share, compared with \$1.07 million or 58 cents per share in 1952.

• **Air traffic** totals led all other international carriers, with 50.4 million ton-miles flown.

Of the 1.6 million passengers carried

last year, Atlantic traffic accounted for 327,338. This was 27.7% of the total number of passengers carried to and from the U. S. by all scheduled trans-Atlantic airlines.

Pan American also maintained its leadership in the Pacific and Latin America. Pacific traffic to and from the U. S. rose up 42.1% over the previous year, and one out of every two passengers going between the U. S. and Latin America flew with PAA.

These are records that will be hard to best, but management is confident this year will be even bigger.

• **Low Fares**—The low, says Pan American, will be maintenance of the proven successful policy of "bringing interna-



TOURIST CUSTOMERS found in Hawaii took a Pan Am Stratocruiser on the West Coast.



TRAPPE: Under the most of check.

tical as travel within reach of the lower income groups by making it not able at the lowest possible fares.

In keeping with this policy, PAA has made the following accommodations to its lowest income fare last year:

- Extension of aircraft flights from Europe to India.
- Introduction of tourist service on Pacific routes.

- A 40% increase in trans-Atlantic coach flights.

- Introduction of direct service from Chicago and Detroit to Europe.
- Addition of direct one-plane service to Caracas and the Scandinavian countries.

- Introduction of the "jet-lag" plan.

The inauguration of tourist flights on the Pacific coast is considered particularly significant since it was the first link in PAA's globe-circling route without tourist service. Now a passenger from any of the West Coast cities is able to fly completely across the world, by the most direct route and with stopover privileges, for \$1,947.55. First-class fare for the same run is \$1,904.55.

The heavy increase in trans-Atlantic coach service is based on forecasts

for a total of 10 million to Europe, with over 200,000 Americans expected to visit the continent. Short vacations and limited funds will be no deterrents for a great number to make the trip by air, especially coach, this year.

Introduction of direct service from Chicago and Detroit is expected to develop potential sales from the midwest cities, as well as to attract, indirectly, unexploited, midwest officials.

Big income passengers are expected to be the recently introduced "jet-lag" plan (Aviation Week, Apr. 17, p. 18), whereby passengers are permitted to pay for second-class tickets as an adult's first-class ticket, while the same is for most adult's income ticket. Since it is a scratchy new experiment, it is not figured as PAA's second-class increase hereafter for the year, but obviously expects that the "jet-lag" plan should account for a 25% boost in sales.

► **First-Class Campaign?** But all the does it mean that he is de-emphasizing our first-class service, says Lippincott.

"We fully expect that first-class passengers will account for about 44% of our overall traffic total for the year."

In view of pointing up its continuing increase in first-class traffic, Pan American is offering a free dinner before this year to the first of private stations on trans-Atlantic flights.

Carrying a surcharge of \$125, these stations will be available for single passengers, while two first-class fares are paid. Tickets include full reclining lounge chairs, bath-tubbed shower, private toilet facilities and many other "luxury" details. In addition, station passengers have a dinner of choice rather than meals served at one time and board the aircraft ahead of all other passengers of departures and arrivals.

► **Europe-Chicago-Pan American** has introduced changes in cargo regulations too. Now strict introduction of a

restriction system for cargo, shipped by air, since for goods on aircraft is usually the same way in passenger space is reserved.

In addition, an increased number of flights has been added with more as the year.

President Juan Trippe says the total carrying capacity of the PAA fleet will be increased by one-third during the year.

► **First-Class Equipment.** The company has new Douglas DC-7Bs on order for delivery, sometime next year. Although PAA has a standing order for three de Havilland Comet 3 jet airplanes, management indicates that it is keeping a close watch on jet transport developments in this country, considering on the Boeing 707, Lockheed's 191 and the Douglas DC-8.

But facts will speak for the Comet 3 while will be C-47A Aeromarine Airline's contribution.

N.Y. Breaks Ground For Airline Terminal

Ground was broken today for New York City's West Side Airline Terminal.

Major leases of the structure, scheduled for completion early next year will be the West Side Terminal Corp., a company which owned by American, Eastern, National, Northwest, Trans World, Allegheny, Midwest and United Airlines.

Once the terminal is completed, but running late to Newark Airport via the Lincoln Tunnel and the New Jersey Turnpike will be reduced to about 25 min. Present Newark passengers must use the East Side Airline Terminal, which spans a five-minute drive to the city.

The building will consist of three stories, with a basement garage for 175 cars. On the ground floor will be a public parking area, 350 spaces of, all-air ticket counters, a bank, restaurant and bar, shops and a heliport on these sides of the bridge.

American's transportation headquarters will be located on the third floor. Restaurants space will be devoted to offices and passenger and baggage handling. Lounges, waiting and waiting area of airport buses will be conducted on the premises.

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airline, as proposed that the account be turned over to private ownership and operation.

"It is unfortunate," says Johnson, "that the Committee on Federal Tax Policy apparently thinks that the federal government can drop the expense of its aircraft maintenance, as though it could by year reduction of aircraft expenditures in the future dealing with some type of maintenance or complete elimination."

"The complete aircraft system is absolutely necessary for military operations and if the Civil Aeronautics Administration were unable to pay for it the Air Force and other military branches would be forced to do so."

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Scheduled International Civil Air Transport Development

		(in millions)			
	1947	1948	1949	1950	1951
Passenger-carrying	728	23.8	21,718	286	35
Freight-carrying	1840	23.5	12,999	286	134
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Source: Bureau of Civil Aeronautics, U.S. Department of Commerce

World's Airlines Set Safety Record

U. S. skies also chalk up low-fatality record; carriers of ICAO member nations show passenger traffic gains.

Airlines of International Civil Aviation Organization member countries set a new safety record of 1.36 fatalities per million passenger miles flown in 1951. This was 21% lower than in 1950. The previous low 32 million passenger miles during the year.

U. S. scheduled airlines carried 31.5 million passengers with 45 fatalities per 100 million passenger-miles, Air Transport Association reports.

► **Traffic Increases.** In a year-end report for the eighth ICAO accident survey in Montreal in June, the international organization states that, exclusive of China and the USSR, airlines of member nations flew a total of 25,460 million passenger-miles during the year.

Passenger traffic fell 16.7% since 1950. Average percentage of annual increase in traffic over 1947 has been 16%. Load factors decreased slightly from 54.5% in 1950 to 54.1% in 1951.

"The extent to which travel traffic is responsible for the maintained rate of growth is problematic; 1951 was the first year in which tourist operations

may be said to have approached the natural limit in the international field," ICAO reports.

"It is highly probable that the large volume of travel based on the long flight across the North Atlantic was the major factor causing the average damage caused by airline passengers to rise in 1951 for the second consecutive year."

► **PAA Leads.** The report says Pan American World Airways, which flies more traffic internationally than any other airline, carried more passengers on tourist flights than on other flights. PAA aircraft passengers accounted for 870,000 or 51% of all its passengers.

North Atlantic air passengers also increased an estimated 51,000. Of this number, 60% flew tourist class. However, ICAO points out, "This is far short of the estimated 900,000 that would be lost."

► **Cargo Load.** International cargo traffic increased 7.4% and 3.5% over the year of increase in aircraft in last year's report, to the fact that more than two-thirds of all airlines international mail and express operations are in air. Secondly, high cost of airmail compared with regular mail is seen as a deterrent.

Rate of increase of cargo traffic on scheduled air services is below that of passenger traffic for the past three years. During the last two years, it has been less than half as great. Between 1947 and 1950, the rate of increase was between two and five times as great as that for passengers, ICAO reports.

► **Revenue.** Firmly, only 1951 figures are available in person. That was the first year that estimated operating revenues of the airlines exceeded \$3 billion.

Revenues totaled \$2,399 million in 1950.



CARGO SHIPMENTS get space reservations in same manner as passenger traffic now being

existing expenses were \$2,853 million for the period.

That is a 22.2% increase over 1951 and 15.7% for expenses. Passengers contributed 75.5%, cargo and mail about 22.4% and charter services and students about 4.1% of the total revenue.

ICAO says "operating figures for 1953 indicate a slightly less favorable picture than for 1952." Best estimates available are that revenues amounted to approximately \$2,503 million, an increase of 13% over 1952. Operating expenses were \$2,516 million, an increase of 15.6%.

Shift to Coach

- Eastern begins increased low-fare operations.
- Rickenbacker forecasts 65% tourist service.

Eastern Air Lines starts next week on what it expects to be a continuing swing to increased coach operation on a system-wide basis.

About half of EAL's entire service

will be coach after May 16, when day and night tourist flights to transatlantic points are added as summer schedules become effective. Right now the proportion of coach to first-class is less than a fourth.

Between Lockheed Super Constellation, until now in first-class operation, will be "upgraded" into Eastern's 14-600 air stream to increase the number of day and night coach flights from 12% to 50% of the total. Constellation will expand seat capacity from 58 to 95 in some of them.

• **Mass. Lakes-Capt. Eddie Rickenbacker**, chairman of Eastern's board, on the step as a beginning. The old operator of a jumbo conference he believes that by the end of next year 60% to 65% of the line's operations will be coach.

"He expects the increase to be steady, without retrenchment when winter schedules are resumed next fall. No retrenchment of first-class flights, he says, will encourage the current increase in coach service."

"We won't make the money we made a year ago," he comments, "but we hope for a sustainable profit." Eastern, he says, has a record of 15 years "no black ink."

The line operates 270,000 plane-miles every 24 hr. with 276 flights daily. Its profits during the "the Year" scheduled air curfew leads the more particular significance.

• **Readjustment**—Rickenbacker explains the step to get a bigger chunk of the more transportation market as a "broad commercial readjustment," part of a move to meet the "philosophy and psychology of the times."

First-class service, he says, has been meeting the public's desire for "more for the same money" while coach service provides the "same for less money."

He characterizes the difference between the two types of accommodations as primarily one of cost.

• **Capacity based**—Rickenbacker's idea let some statistics to show the increased revenue will provide capacity for about 1.5 million additional passengers annually, compared with 1-175 million carried by the entire air transport industry in 1952.

They will give EAL daily aircraft capacity for 4,972 passengers (plus extra seating), with 1,750,000 aircraft seat-miles scheduled by the carrier every 24 hours.

The expanded coach schedules will move 25 major cities on Eastern's network covering 24 states and Puerto Rico.

Example: Between New York and Miami, one of the carrier's most lucrative runs, there have been three daylight and two night coach flights. Now the

weekend goes to eight, half day, half night.

• **Increased Service**—Cities that will receive improved EAL coach service under the new schedules include Pittsburgh, Birmingham, San Antonio, Houston and Jacksonville. Washington and Atlanta service will be doubled, and the increase will come both day and night coach service to Philadelphia, Baltimore, Louisville and Charlotte, cities that have had day coach only.

Additional daytime coach flights will be between New York and Houston, New Orleans, St. Louis and Puerto Rico, and between Miami and Boston, Chicago, Detroit and Los Angeles.

But so coach "thrust" between Washington and New York is contemplated. "Cost would be too great for such a 'sheepfold' operation," Rickenbacker comments.

• **DC-7s**—Coming—Just a year from now, Eastern will receive a fleet of Douglas DC-7s, but they will be used in first-class service to avoid "upgrading" into the 193-600-sq. ft. level, EAL says.

(Rickenbacker does not look for the advent of commercial jet transports "short of 1962.")

In the meantime, the carrier says the new push on coach operation is part of its "program for giving its operations to this point of maximum adjustment."

The other contribution is in putting into first-class service of a \$10 million fleet of Turbo Compastral Super Constellation answer to the public demand for "more for their money."

Sked Revenues Top Record \$1.2 Billion

Passenger traffic accounted for about 85% of total scheduled airline revenues during 1953, Air Transport Association reports in a brief statistical study for the year.

In 1952, the percentage was 80.22. The airlines carried 51.4 million passengers more than 100 miles passenger-miles, a gain of 14% in passenger and 65% in mileage.

Mail ton-miles totaled 56,928,000, 6.1% higher than last year. Express and freight amounted to 251,375,000 ton-miles, a 12.5% increase.

Operating revenues in 1953 topped the previous year by 13%, increasing to a new high of \$1,275,945,165.

Average service showed some growth in 1953 then was other single segment of scheduled airline operation, ATAs says.

This class of traffic has grown from about 151 million passenger-miles in 1945 to nearly a total of 4 billion in 1953.

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MILES MICHIGAN

Black Market

- International ring loots airlines, reporter says.
- Bootleggers also to sell fighters to Red forces.

Airlines have been victimized by an international black market ring dealing in the "bootlegging" of planes and spare parts, according to a recent article in the New York Journal-American.

In what he terms an "unknown" report resulting from thorough investigations, Journal-American reporter Clay Richards says the ring does an estimated annual business in excess of \$12 million a year in the illegal sale of planes and parts. Military equipment, too, is said to be involved.

Airline, military and government sources quoted by Insurance Week have not refuted the findings but decline to give further information for "security" reasons. The FBI is working on the case, they say.

Red Customers—Two "big military deals" currently are being placed, according to the article. First is for the sale of 15 P-51 Mustangs which would bring as much as \$100,000 each, intended for an unidentified Central Asian power that has been denied an export license by the U. S. State Department.

The second is for 10 Mustangs to be shipped to the Communist Viet Minh forces in Indo-China.

Richards quotes a spokesman from the State Department responsible for granting export licenses for all types of aircraft and parts who said: "The problem of bootlegging who are the real buyers of the material in the deals submitted to us is one of our major concerns. It is often a very difficult task."

Systematic Theft—Several of the major airlines who first believed their inventory losses in parts, instruments and other equipment were only a substantial theft problem, have awakened to the fact that they have been systematically victimized by the ring, notes the newspaper. They now have teamed up to file the FBI the article adds.

Here are several typical instances cited whose airlines have been "booted" in the black market:

• Eastern Air Lines had a large number of copper shrouds, copper wire DC-4 engines and other vital parts stolen at Miami recently. They were traced to a spare parts dealer in the same city. The dealer agreed to return the material to Eastern but not payment.

• American Airlines lost 1,000 spark plugs valued at \$150 each from its La Guardia Airport inventory. Suspec-

ing this would have been into the black market, AA began vent into that market for new plugs.

They bought an equivalent number, noting that the serial numbers were close but not identical to the missing ones. However, it was soon established that the new ones bore a type mark, showing that they had been inspected and stored by Pan American World Airways—and undoubtedly stolen from PAA.

• Trans-Canada Air Lines lost 23 two-point indicators, worth \$500 each, stolen at Montreal Airport. These traffic were found in the possession of the RCMP, which had bought them from a Canadian parts dealer with American connections who claimed he had acquired them legitimately.

American also noted it was consuming 5,800 pacifier deicing brushes throughout its entire system in an eight-month period, with New York using 5,100 while the rest of the system accounted only 700. Security officers traced the missing brushes, through a suspect parts dealer, to warehouses of Pan American, Boeing, Western and North-west Airlines in several cities.

In another theft reported by Lockheed, the ring answered a custom call from Pittsburgh for a C-46 engine. The call supposedly came from a stocked airline. An aircraft was engaged, arrived and to Richards' amazement, was stolen from an Air Force base in Florida, flown to Pittsburgh and installed for about \$4000. The base-out engine reportedly was flown back to Florida to replace the stolen one.

Grace Follows PAA Lead in Panagra Suit

W. B. Grace & Co., following the lead of independent Pan American World Airways, has filed its answer to the Department of Justice suit that seeks to assert the two companies' control of Panagra.

Taking much the same stand as the one taken by Pan American (Aviation Week May 9, p. 26), Grace points out that the joint ownership of Panagra had been disclosed to, and approved by the government through its various agencies, including Civil Aeronautics Board, over a period of years.

The company says the relief asked by the government is "unreasonable and contrary to the public interest" and that Grace itself is not a monopoly in its transportation but has acquired power to monopolize.

In answer to the charge that Panagra had been restrained from developing competitively, Grace says the airline's record since it began operations in 1950, has been one of "continuous growth."

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SHORTLINES

► **Small Airways** operating permit in Peru has been extended by the Peruvian government for an additional five years.

► **British European Airways** chairman, Lord Douglas, says the British may have to buy Boeing's 550, because of availability of U. K. helicopters before 1955 or 1960. The airline and British Overseas Airways Corp. have concluded an agreement with the projected German civil airline Luftag, providing for material cooperation and insurance.

BEA also is discussing mutual arrangements for parallel routes with the Civil Aeronautics (TAE), including pooling of services and ground service facilities.

► **Capital Airlines** has begun one-plane through service from Milwaukee and Minneapolis-St. Paul to Miami, in air-sharing agreement with National Airlines.

► **KLM Royal Dutch Airlines** has begun two additional flights per week to Milan, Italy, giving that city five flights a day at which drop in Frankfurt. KLM is offering an air cargo route for use by truckers and similar organizations free of charge. The airline has received permission from the Soviet High Commission in Berlin to operate flights in and out of the East German capital. West German officials reportedly will object.

► **Pan American-Guest Airways** has started new DC-6 tourist service to Argentina, with a stopover operation between La Paz, Bolivia, and Buenos Aires. The two from Miami to the Argentine capital is scheduled to take 22 ft., 40 min., using Pan American World Airways' routes between Miami and Panama.

► **TransCanada Airlines** System has opened a district sales office in Montreal, Quebec, as it expands its North American activities in Canada.

► **TACA International Airlines** has reduced its passenger fares from New Orleans and Mexico City to Central America and Panama by as much as 30%.

► **Transportes Aereos Portugueses** will begin operating from Portugal to South Africa next May, first stop in a long-term project to link the country's passengers to Africa, South Asia and Australia. The Portuguese airline plans to start the operation with DC-6's, will switch to Super Constellation when the new transports are delivered some time next year.

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Capt. Rickenbacker Dissents

While some of his fellow airline presidents quietly were exploring possibilities of increasing fares, Capt. E. V. Rickenbacker decided to stage a press conference last week to tell the world his Eastern Air Lines, beginning May 16, will raise rates more than 50% of its trunkline service at low-level carrier operations.

That decision, coming from the industry's champion money-saver and revenue-chaser, should be a warning to those who are more interested in raising profits than filling their airplanes.

The nation's airlines are going to have to readjust their service pattern in keeping with the new lack in the country's economy. Rickenbacker contends strongly.

"The result of the industry's last-quarter operations points up the impact that the country's broad economic readjustment has already had on the airlines," he says. "These results should not have surprised anybody. They were forecast months ago. Technical advances within the industry, however, have brought the airlines to a critical point in their development and into the very guts of the changing trend in the economy."

"Whether the industry wants it or not, these factors are forcing us into becoming a system of mass transportation. The so-called first class travel market is not dropping. It is simply no longer capable of being expanded at a rate required either to make profitable use of the equipment available, or to provide a market load and stable enough on which to protect even most expensive jet-powered transportation. The industry must absorb five or six years from now."

"In my opinion, this type of low-cost public service is certain to replace the so-called first-class market at our primary source of revenue before many years."

For years, Eastern has been the largest domestic operator of aircraft, but less than 25% of its schedules have been used for that service, he said.

Capt. Rickenbacker is under no illusion about his price rate, let his fellow airline presidents note.

"We won't make the money we made a year ago, but we hope for a reasonable profit," he said.

"In my opinion, although revenue from aircraft operations is substantially less per passenger-mile than that produced by regular fare traffic, the wide appeal of this lower-cost service will produce a dollar volume of new business more than sufficient to offset this deficiency."

The Eastern board chairman emphasized the need for "a sizable and expanding system of air transportation."

He scrambled pointedly that he was against raising fares when business is tight.

Rickenbacker believes there is no question that if costs continue to climb, prices also will climb, and in such a period of readjustment, "people just aren't going to spend the money they did, or at the rate they did."

By the end of next year, perhaps 65% of Eastern's operations will be coach, he said. There will be no cutbacks of first-class flights with the new policy May 16.

Capt. Rickenbacker contends his industry again

Lear Sticks Out His Chin!

That dynamic phenomenon, William P. Lear, shrives about the country making more reach of the time, and his address in Los Angeles the other day was so deplorable from confusion.

Bill Lear, who will ask you a novel-type executive place in a time, stuck out his chin as characteristic fashion and became a true-fall apart in the number of business aircraft during the next 10 years, from 5,000 planes to 85,000.

The chairman of the board of Lear, Inc., may turn out to be right. We fervently hope so. Addition of Bill's selling energy alone may get the figure up that high.

Anthony Weiss, however, still refuses to accept as proof the "statistics" on business aircraft handed about by Civil Aeronautics Administration and the National Business Aircraft Association.

Mainly because of the inadequacy of CAA's official figures, as we know how many aircraft really are used for business. We don't know—and neither does anyone else—how many hours of business flying that industry wants total of planes next year, yet, despite estimates CAA and others get both for the year.

We can find big, gaping holes and inconsistencies in official but uncorroborated data. There is evidence of considerable guessing. Even the strongest defender of CAA figures would up a rebuttal of our position with an apology to the effect that the data available for 1951 are not at "complete or as accurate as we would like to have them." That's about the point of our various discussions here.

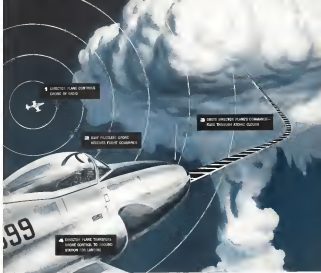
One of our magazine contemporaries which has accepted and publicized CAA and NBAA estimates, without digging into the source material, propounded the astounding editorial policy that "to consistently destroy confidence in any organization that is working for aviation had for the industry." There has been too much of that kind of philosophy in the history of aviation journalism.

It is our view that no one, even if "working for aviation," deserves confidence he doesn't merit. Truth—not reserve—is the prime consideration. In truth "uncertainty"? Aviation can't be built upon "uncertainty" or "misleading" false information. A lot of people may be "working for aviation" who are not necessarily right or well directed, and those who aren't right or sound are doing no service to aviation. Aviation had more than its share of phantoms and parasites in its early days and we repeat in the destruction of their tracks.

Those who are interested in a fuller summary of Anthony Weiss's views of the business flying picture will find it in the March 15 issue. In the confusion you can bank on it that those who still attempt to defend CAA figures on this important subject have never made a study of the source material that gives rise to the published totals, or talked to the people who add up the figures and "make the required assumptions and allowances." We have.

But we still hope Bill Lear's prophecy is right.

—Robert H. Wood



Pilotless Jets Penetrate Atomic Cloud in Tests

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THE STORY BEHIND THE STORY

■ Mix the drama of atomic tests and aviation flight and it's just one more. Such was the case when the U. S. Air Force thrust pilotless jet drones into the heart of atomic clouds and landed them safely—with their cargo of mice and monkeys—for scientific study by the Atomic Energy Commission.

■ The story behind the testing of the effect of radiation on animals is one of pilotless flight, "beep" pilots and precise

Sperry controls. Lockheed QF-80 drones, specially equipped with Sperry remote flight control systems, fly through atomic clouds guided by radio and radar.

■ These drones are flown remotely by skilled test pilots who use "beep" horns to command them—either from director planes in the air or control stations on the ground for take-off and landing. Under their radio commands the drone takes off, at the proper speed reaches its landing gear, climbs to the desired altitude, banks and turns and keeps the computer necessary to arrive at

an exact point in the atomic cloud at a prescribed speed.

■ This remarkable flight control system brings the drone through the sensitive turbulence of the atomic cloud under complete control—on command and without returning to its surface. The radiation-resistant drone lands at precisely its target without pilotless in its control.

■ Sperry is an old hand at pilotless flight. It developed the first guided missile—an aerial torpedo for the Navy—in 1915. And since 1915, Sperry has been the leader in developing automatic flight controls for guided flight. Sperry automatic pilots are installed on military and commercial planes the world over.

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